

# MikroTik WIRELESS REGISTRATION-TABLE

CHALLENGES SOLUTIONS

# Hani Rahrouh

MUM  
Canada, 2019

HOW  
DID  
I  
GET  
STARTED

Coming soon!



2002, Learned networking Cisco, UBNT, Motorola

2008, First MikroTik Certification

2011, MikroTik Certified Trainer

2013, Founded Wireless Netware

2014, MikroTik Master Distributor, VAD

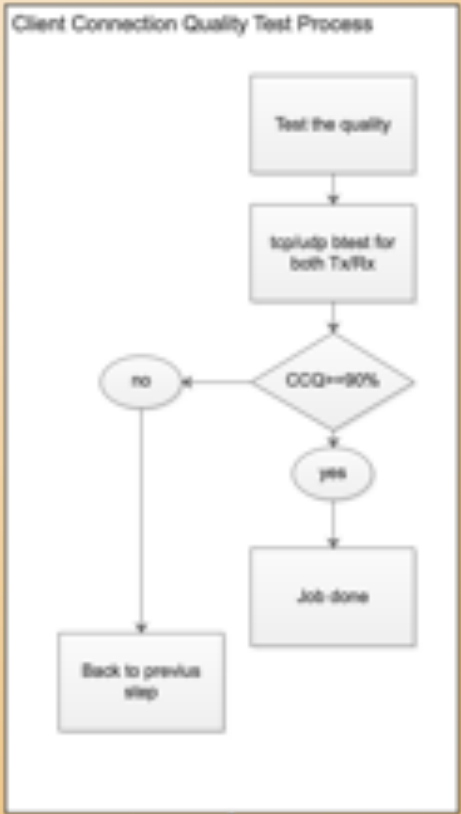
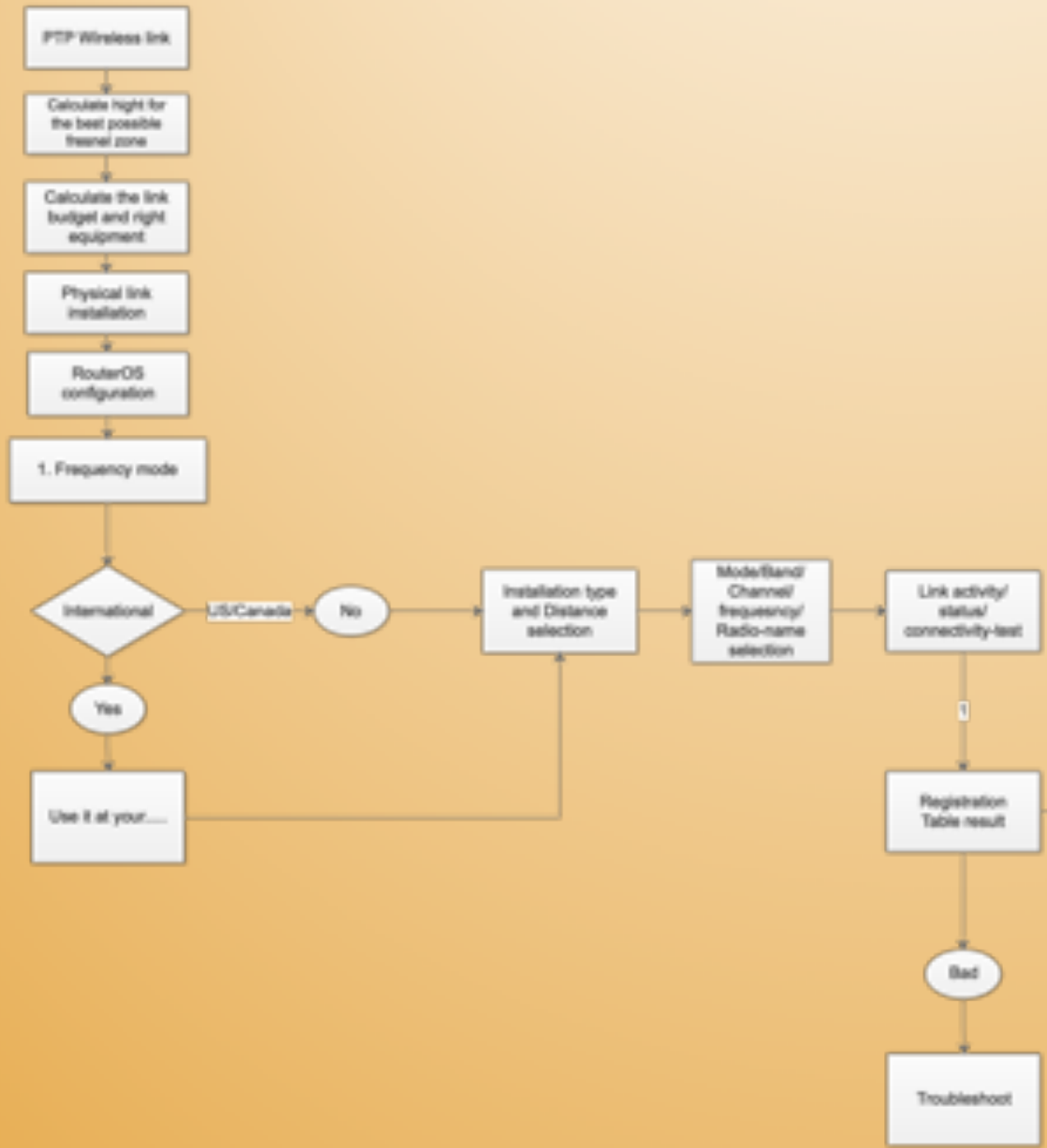
2015, Founded NETWIRE

Bell Canada, Rogers, and Cogent Partner

# Wireless in MikroTik

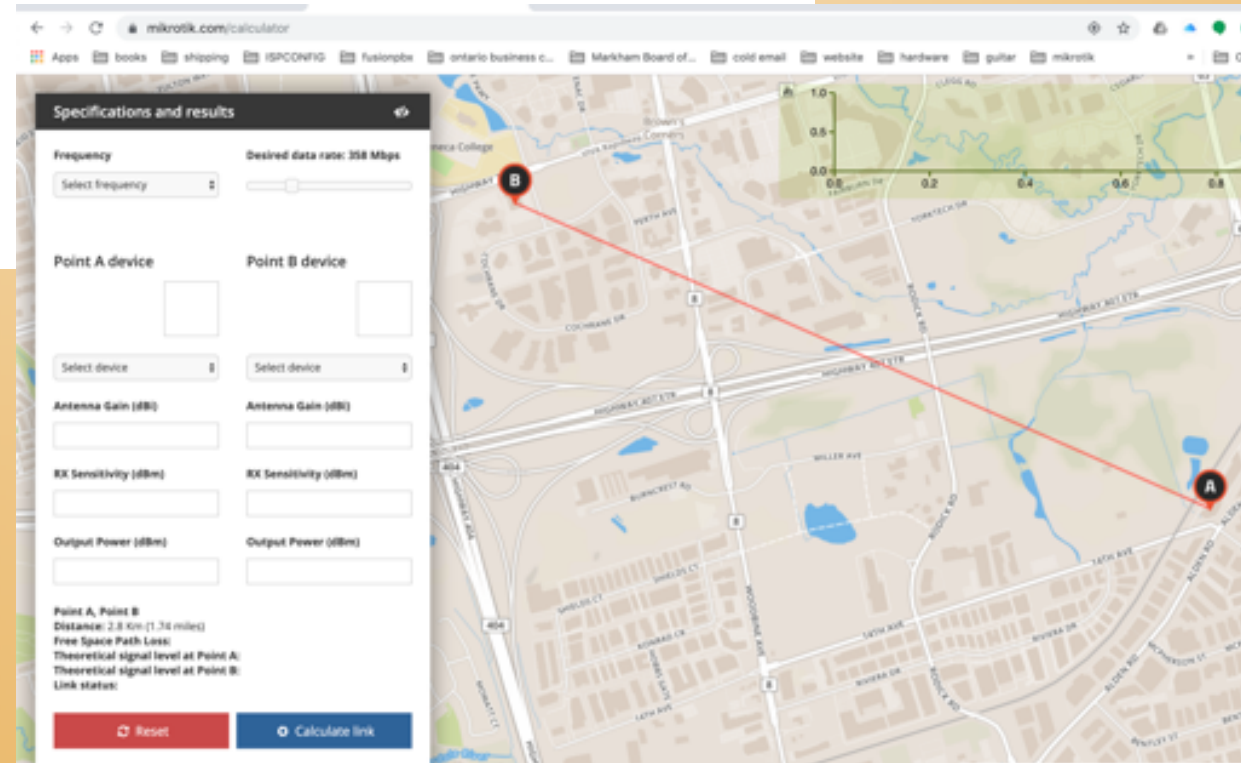
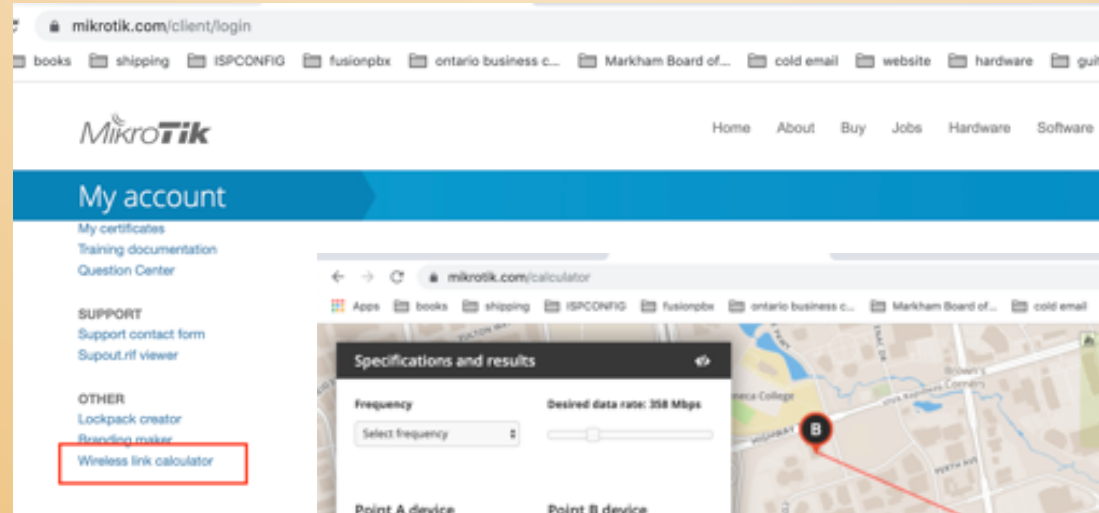
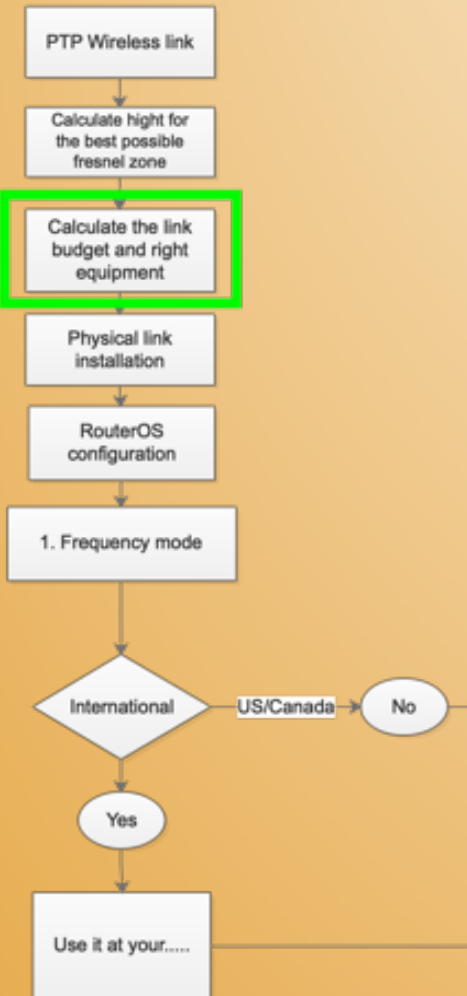
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## Highest Client Connection Quality

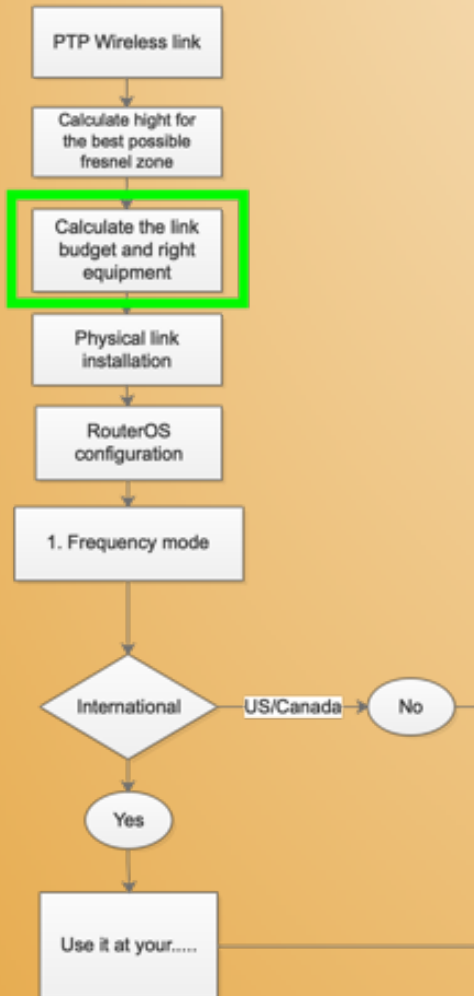


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# Wireless Link Calculator



# Wireless Link Calculator



Specifications and results

Frequency: 5 GHz (dropdown menu open showing 2 GHz, 5 GHz, 60 GHz)

Desired data rate: 358 Mbps

Point A device: NetMetal SSHP

Point B device: NetMetal SSHP

Antenna Gain (dBi): 12

RX Sensitivity (dBm): -81

Output Power (dBm): 29

Point A, Point B  
Distance: 2.8 Km (1.74 miles)  
Free Space Path Loss: 120.759 dB  
Theoretical signal level at Point A: -71  
Theoretical signal level at Point B: -71  
Link status: Unreliable

Buttons: Reset, Calculate link

Frequency: 5 GHz

Desired data rate: 54 Mbps

Point A device: NetMetal SSHP

Point B device: NetMetal SSHP

Antenna Gain (dBi): 12

RX Sensitivity (dBm): -81

Output Power (dBm): 29

Point A, Point B  
Distance: 4.8 Km (2.98 miles)  
Free Space Path Loss: 120.759 dB  
Theoretical signal level at Point A: -71  
Theoretical signal level at Point B: -71  
Link status: Unreliable

Size of 1st Fresnel Zone: 8 meters  
60% of 1st Fresnel Zone: 4.8 meters  
Link is possible but high antenna tower is required

Buttons: Reset, Calculate link

Specifications and results

Frequency: 5 GHz

Desired data rate: 54 Mbps

Point A device: NetMetal SSHP

Point B device: NetMetal SSHP

Antenna Gain (dBi): 24

RX Sensitivity (dBm): -81

Output Power (dBm): 29

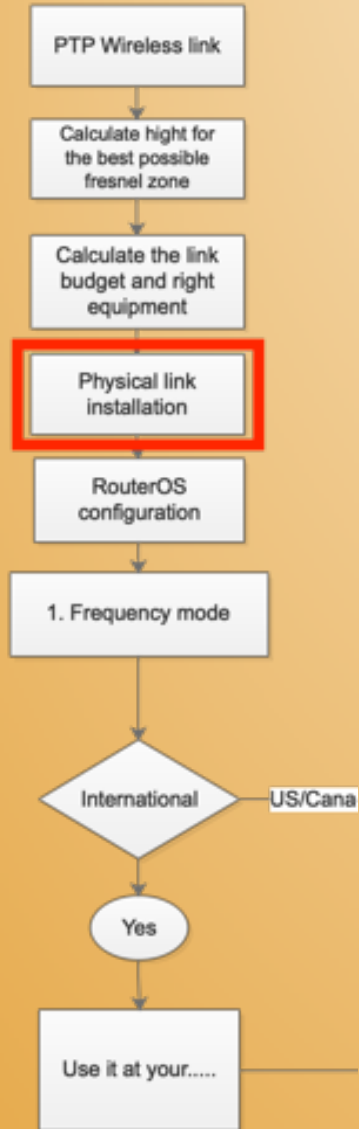
Point A, Point B  
Distance: 4.8 Km (2.98 miles)  
Free Space Path Loss: 120.759 dB  
Theoretical signal level at Point A: -47  
Theoretical signal level at Point B: -47  
Link status: Reliable

Size of 1st Fresnel Zone: 8 meters  
60% of 1st Fresnel Zone: 4.8 meters  
Link is possible but high antenna tower is required

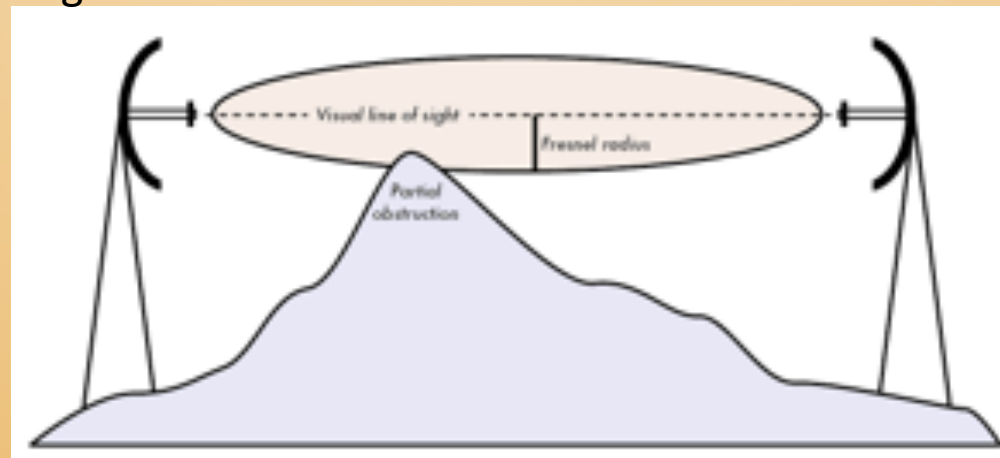
Buttons: Reset, Calculate link

# Physical Installation

## Installation tips



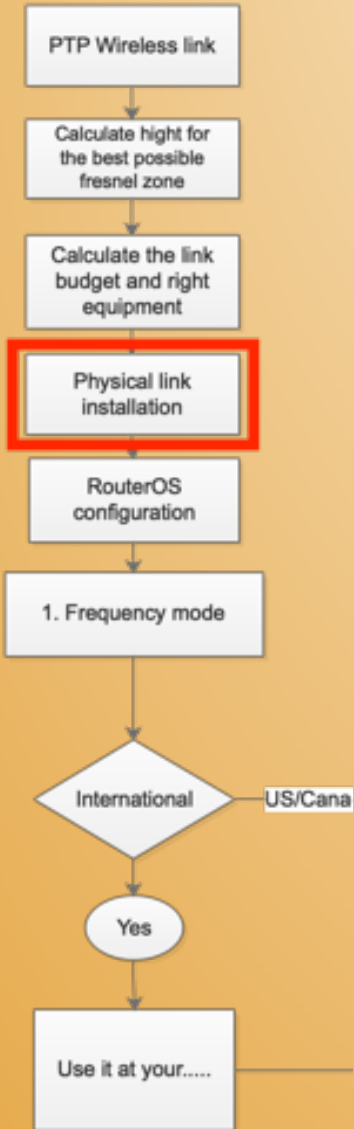
Hight



# Physical Installation

## Installation tips

Connector types “Use Same impedance”



Isolation

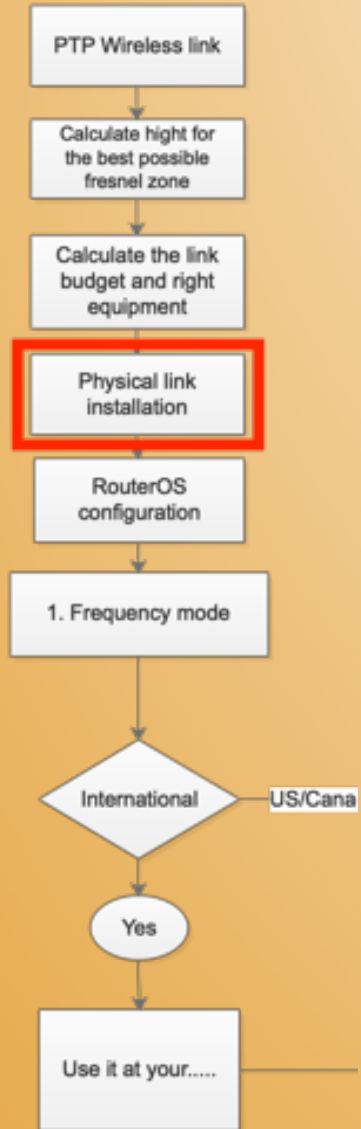
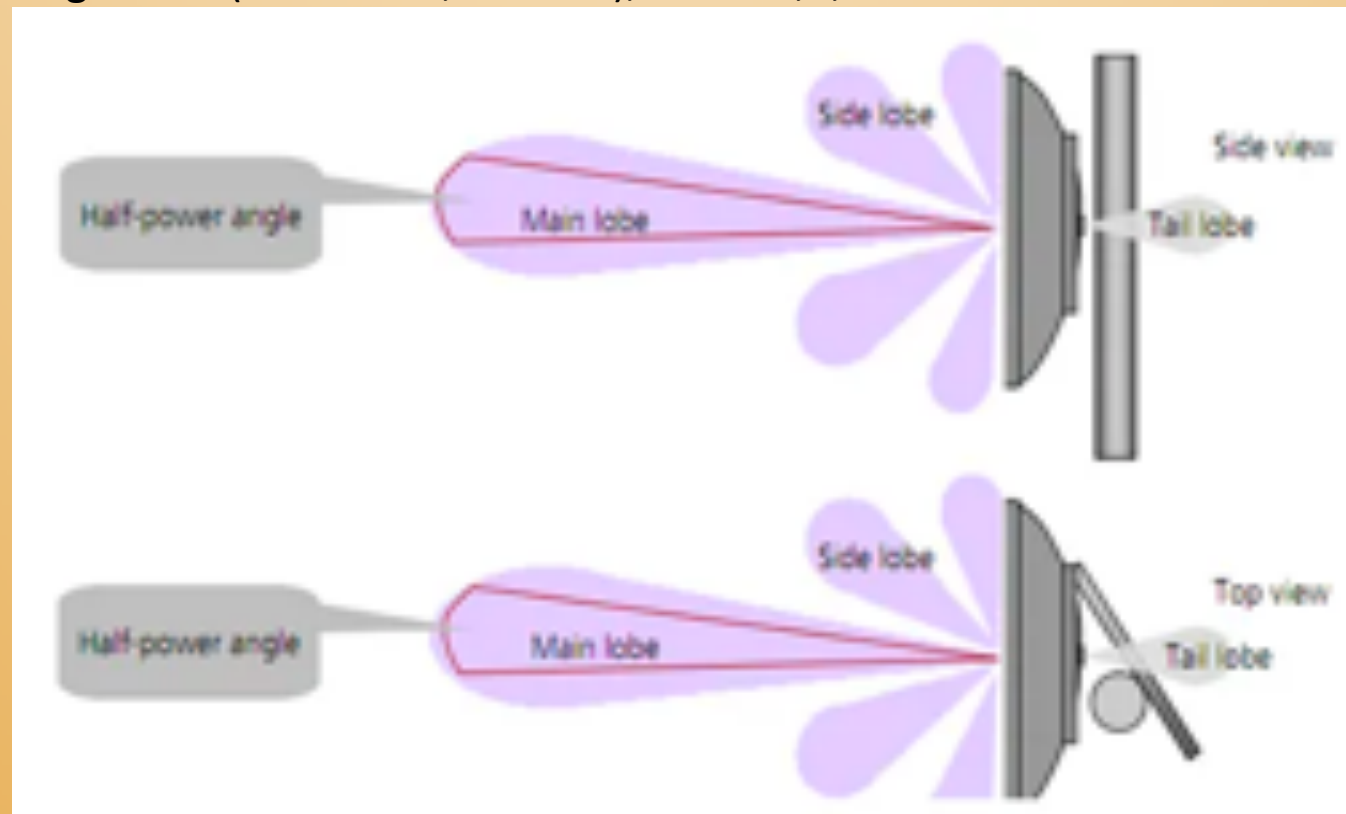




# Physical Installation

## Installation tips

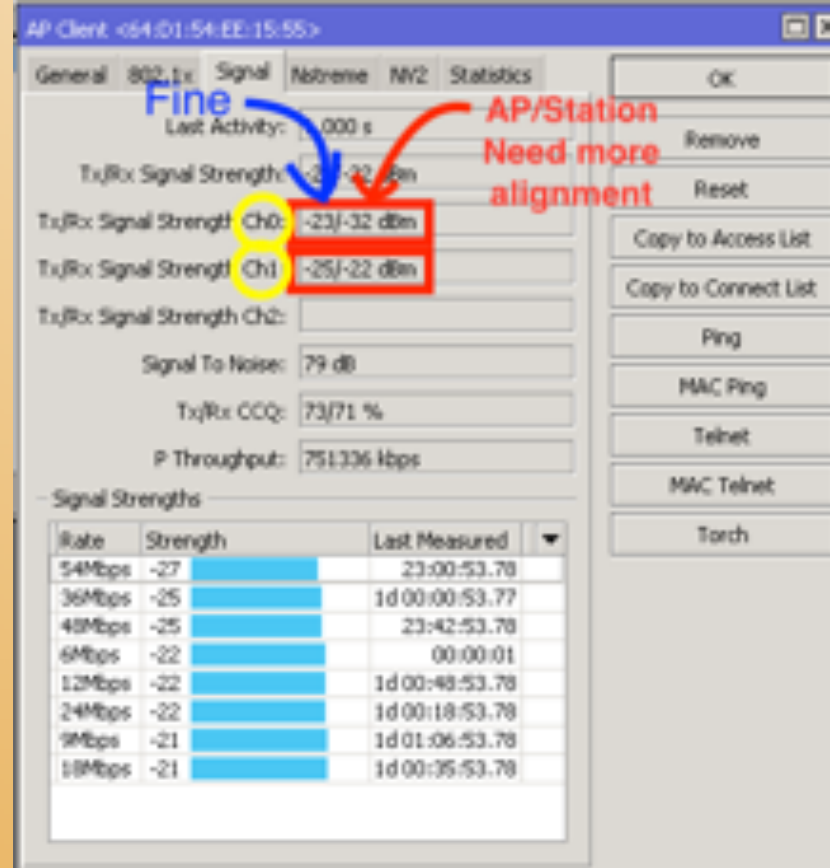
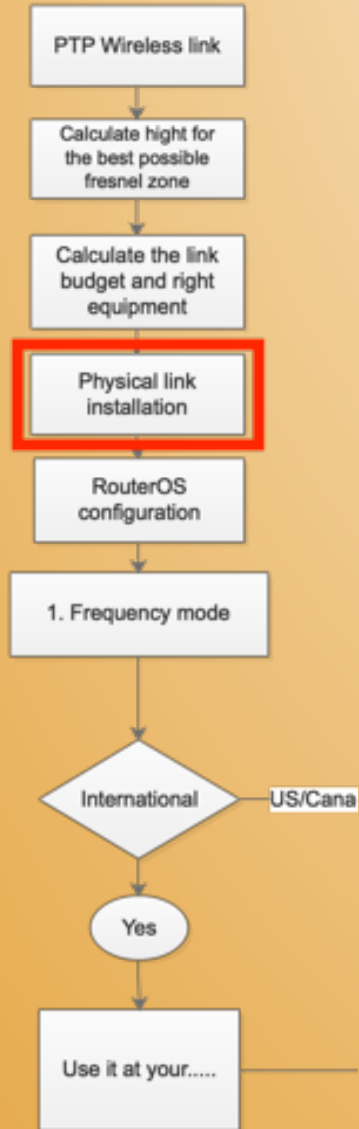
Alignment (Horizontal, Vertical), Chain 1,2,3



# Physical Installation

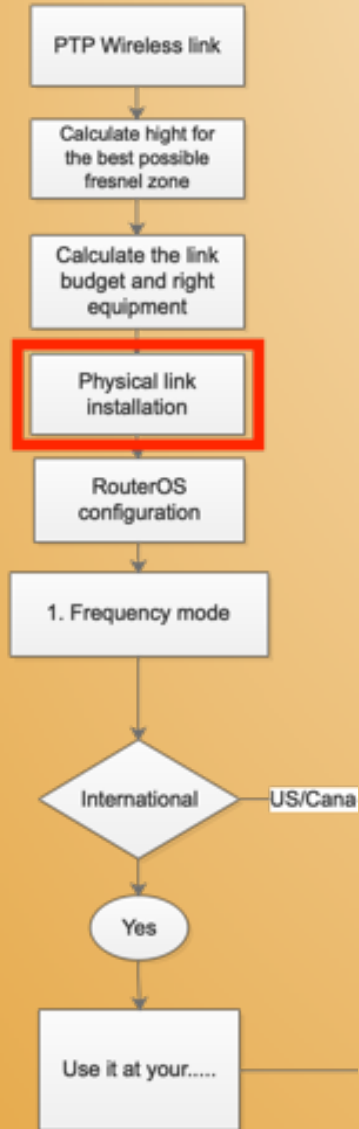
## Installation tips

The best tools on how to align the antenna

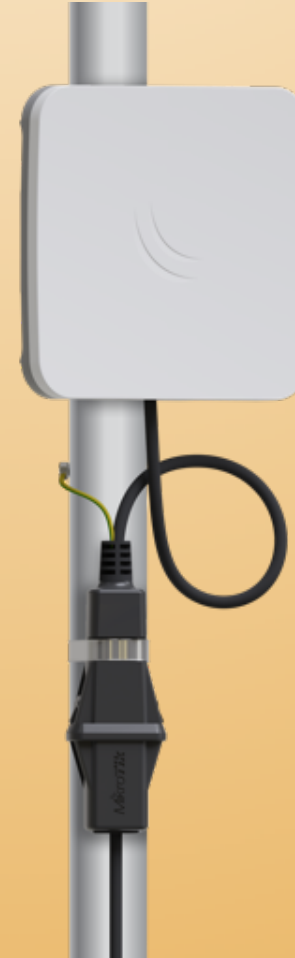


# Physical Installation

## Installation tips



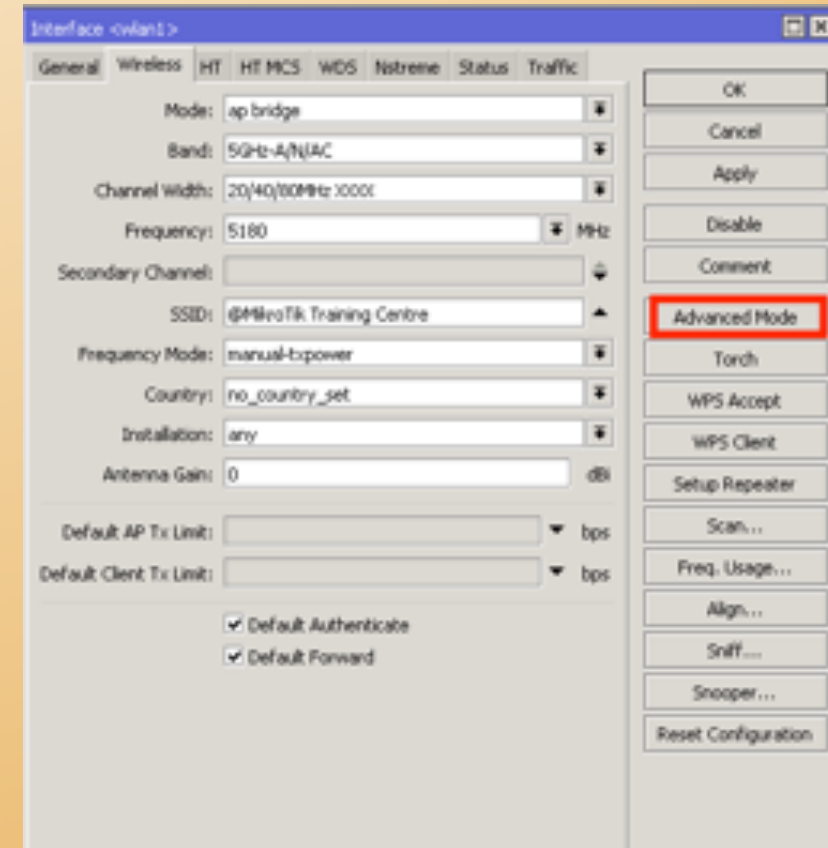
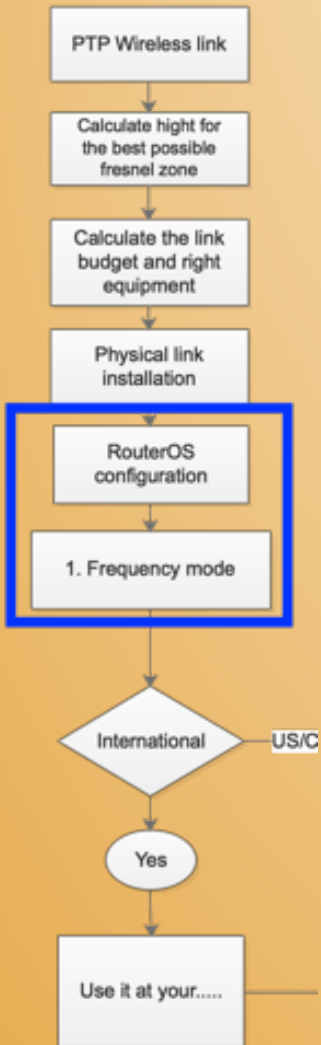
Surge protection



Better antenna alignment



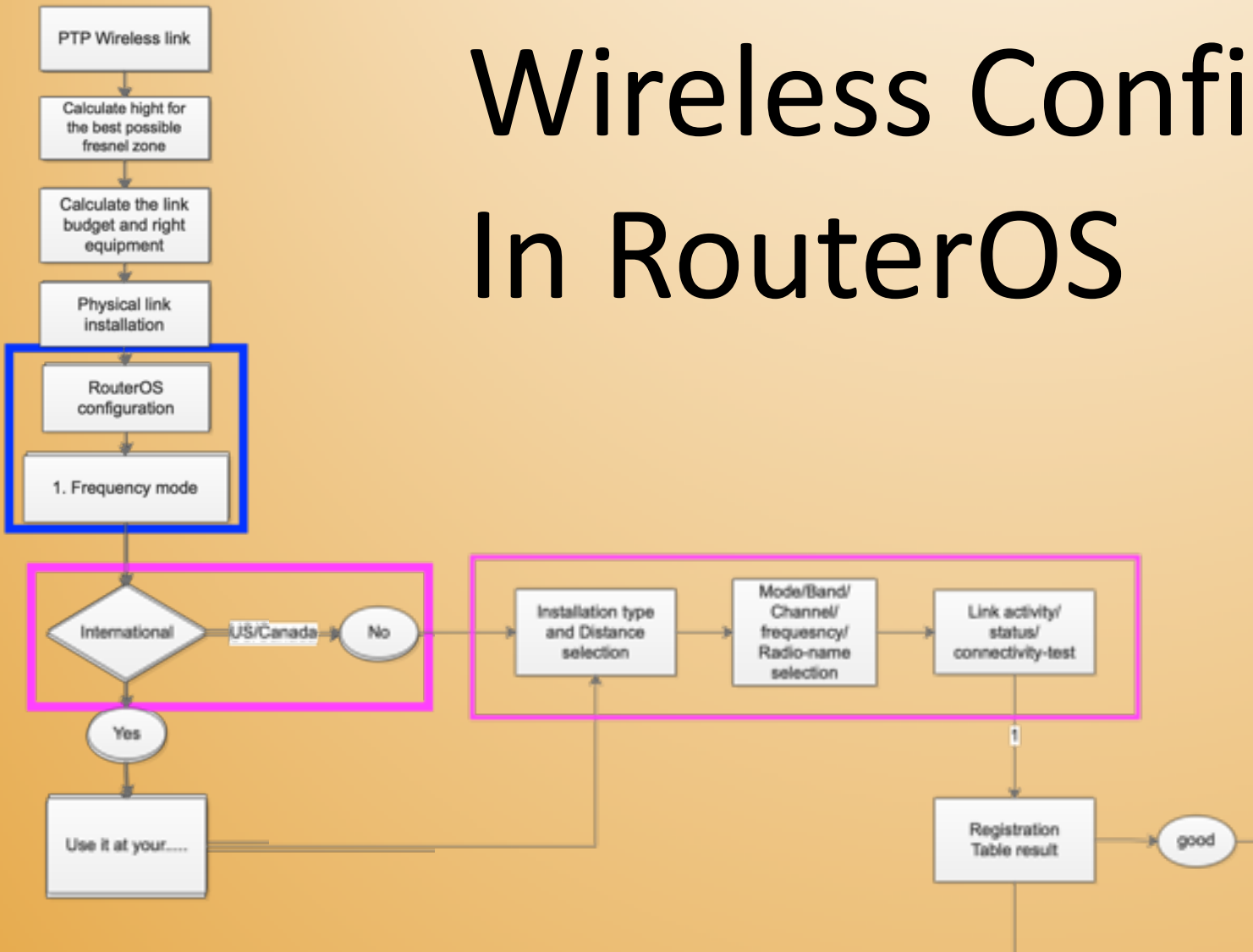
# Wireless Configuration In RouterOS



Point To Point Wireless

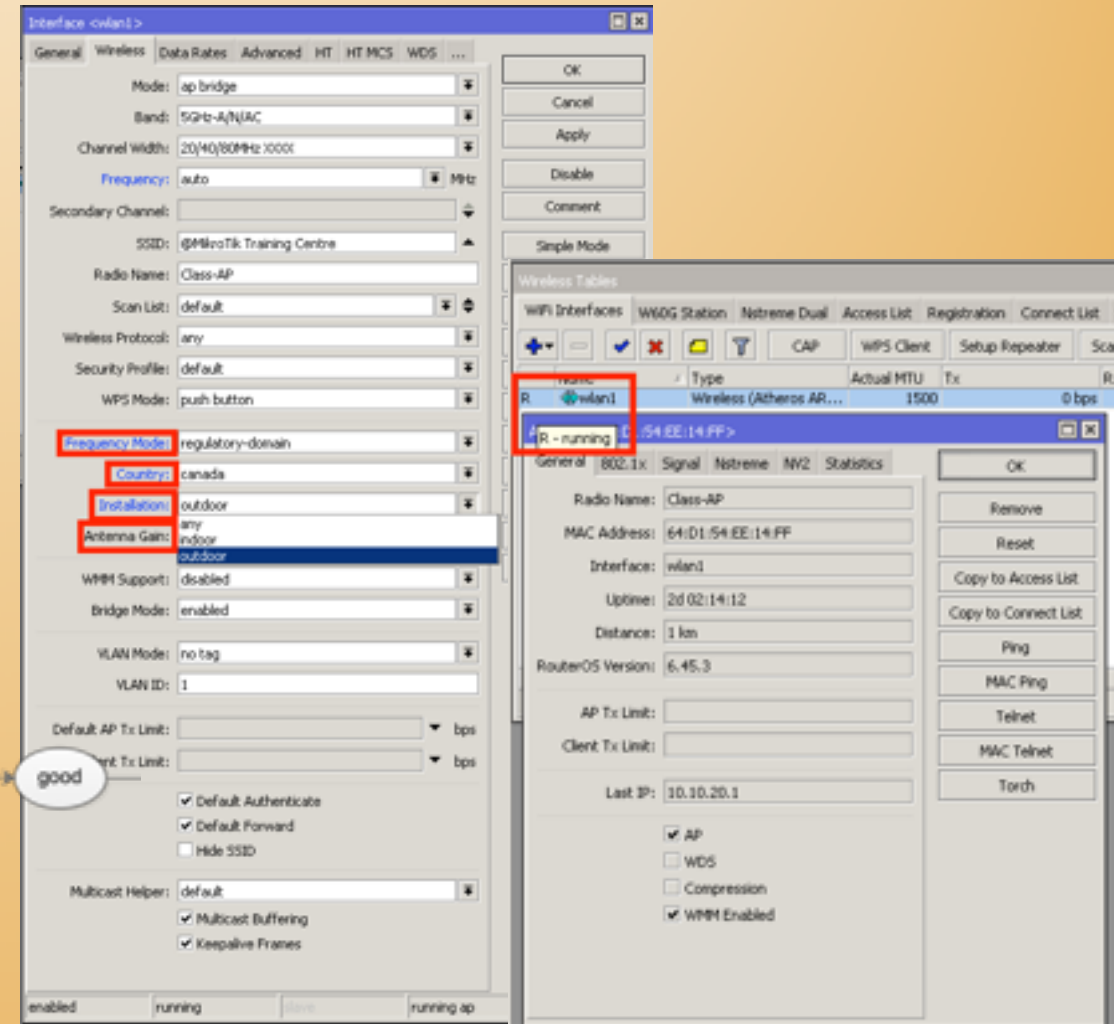
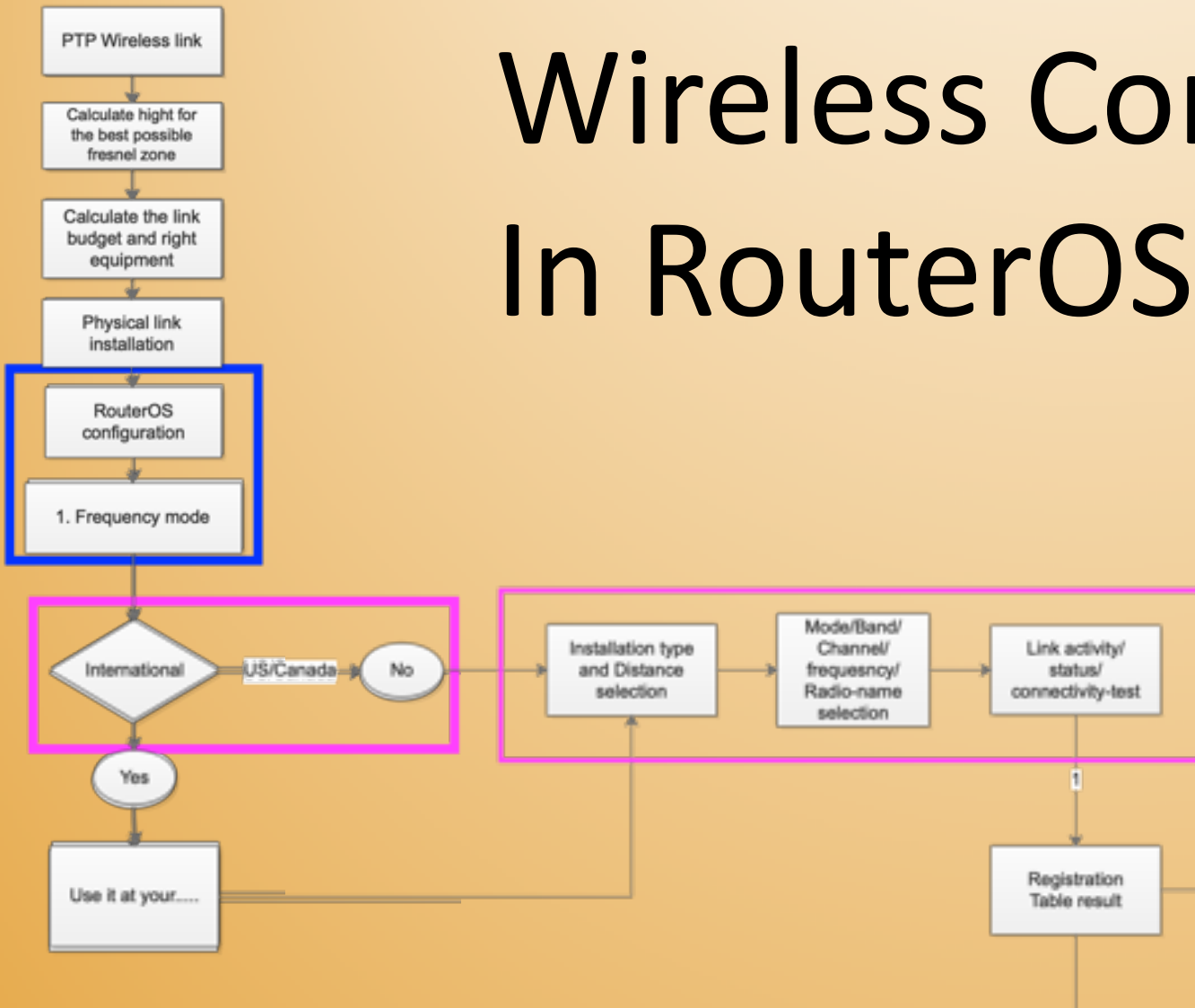
<https://mum.mikrotik.com/presentations/US12/uldis.pdf>

# Wireless Configuration In RouterOS



# Wireless Configuration In RouterOS

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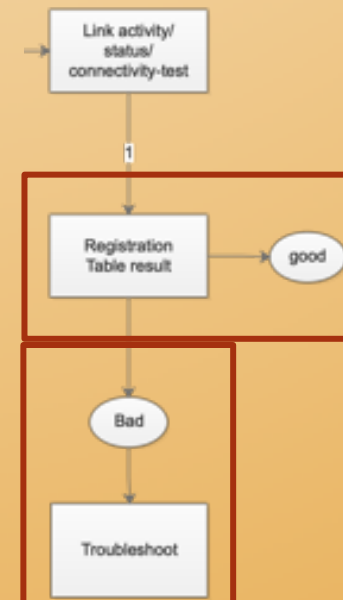
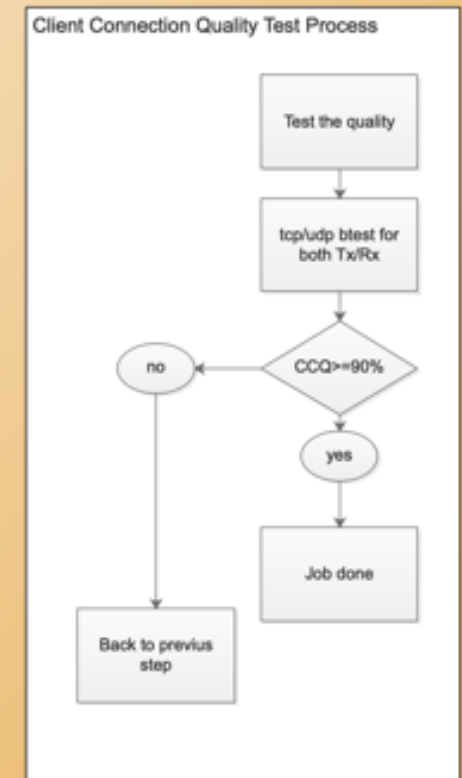


# Wireless Configuration In RouterOS

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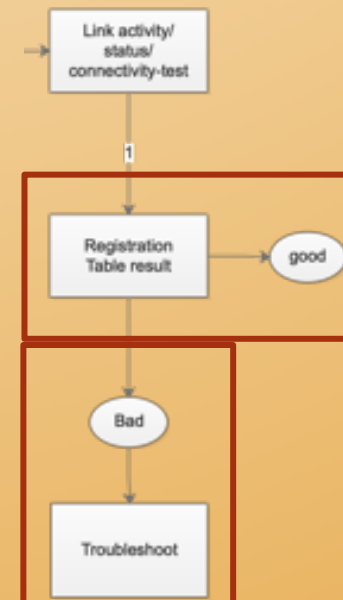
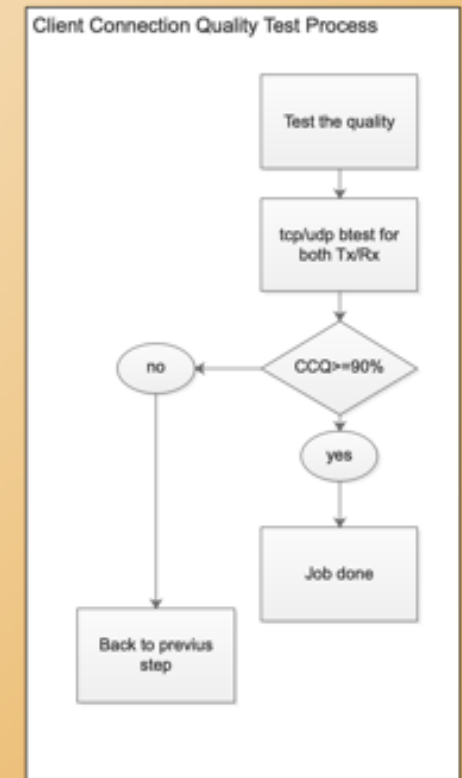
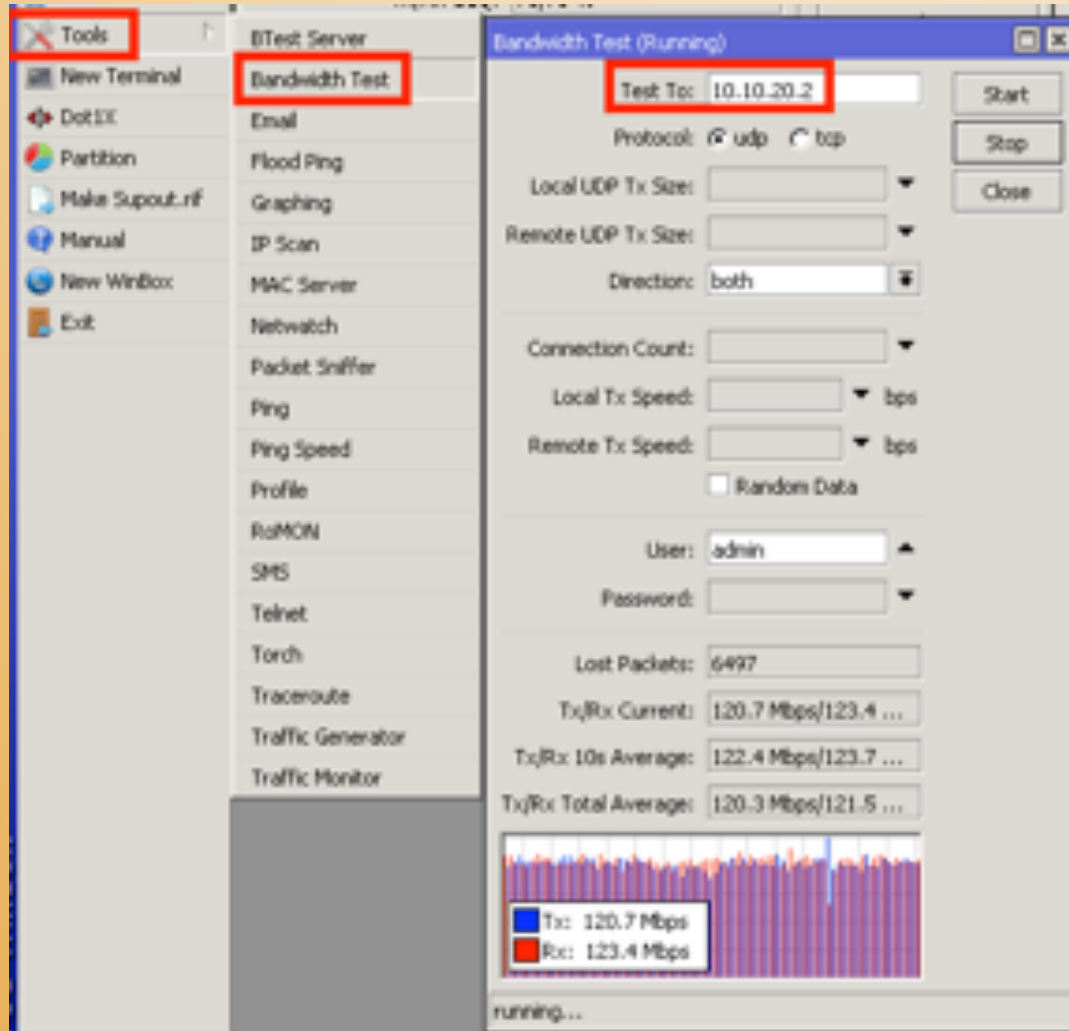
Wireless Station configuration page showing the Registration tab. The Tx/Rx CCQ is 68/62 %.

| Rate   | Strength | Last Measured  |
|--------|----------|----------------|
| 54Mbps | -27      | 7d 20:36:41.78 |
| 36Mbps | -25      | 7d 21:36:41.77 |
| 48Mbps | -25      | 7d 21:38:41.78 |
| 6Mbps  | -24      | 00:00:01.04    |
| 12Mbps | -22      | 7d 22:24:41.78 |
| 24Mbps | -22      | 7d 21:54:41.78 |
| 9Mbps  | -21      | 7d 22:42:41.78 |
| 18Mbps | -21      | 7d 22:11:41.78 |



# Wireless Configuration In RouterOS

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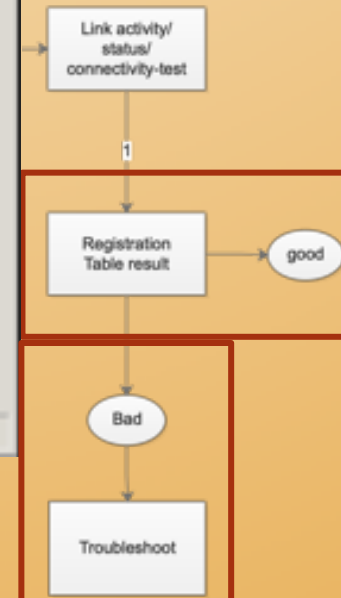
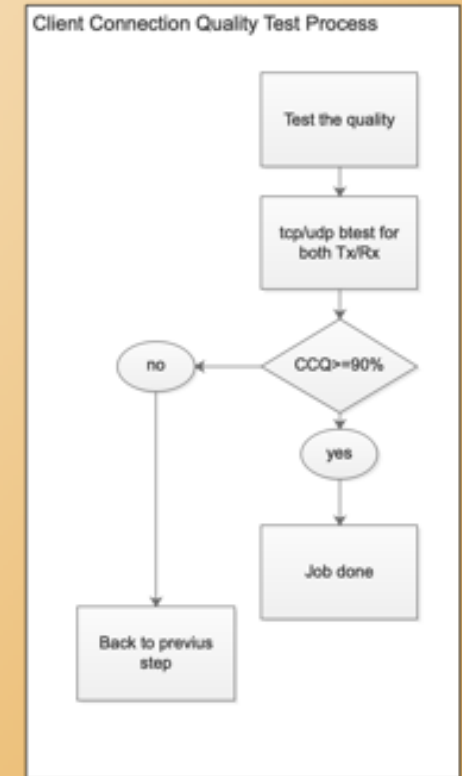
# Wireless Configuration In RouterOS

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The image shows two windows from the RouterOS web interface. The left window is titled 'AP Client <64:01:54:EE:15:55>' and has tabs for General, 802.11x, Signal, Netstream, NV2, and Statistics. The 'Signal' tab is active, showing 'Tx/Rx CCQ: 79/100 %' highlighted with a red box. Below this is a table of signal strengths for various channels.

| Rate   | Strength | Last Measured |
|--------|----------|---------------|
| HT40-0 | -51      | 00:01:15.14   |
| HT40-1 | -51      | 00:01:14.31   |
| HT40-2 | -51      | 00:01:13.23   |
| HT40-3 | -51      | 00:00:00.01   |
| HT20-0 | -48      | 00:00:00.38   |
| HT20-1 | -47      | 00:01:14.38   |
| HT20-2 | -47      | 00:01:13.52   |
| HT20-3 | -47      | 00:01:12.59   |

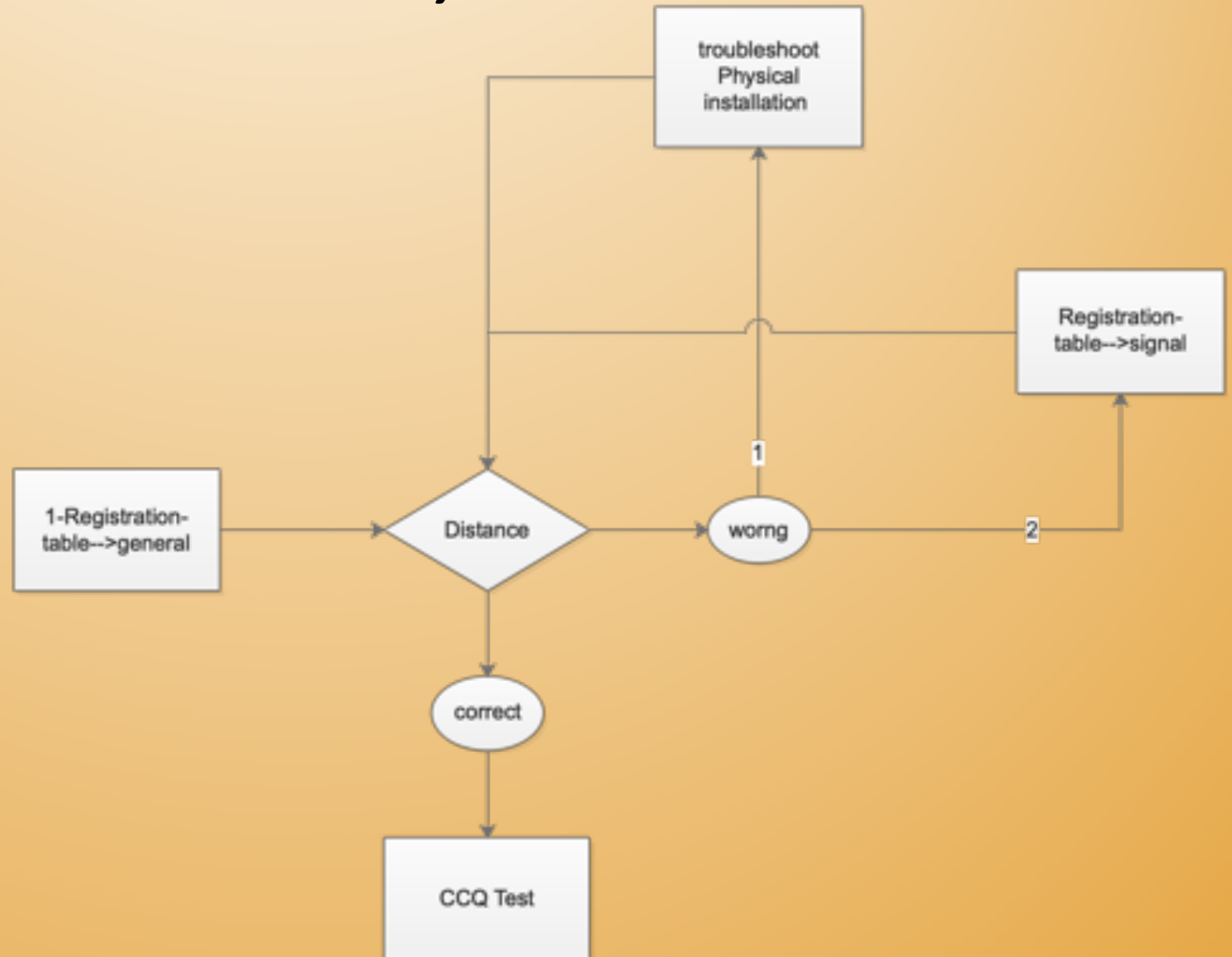
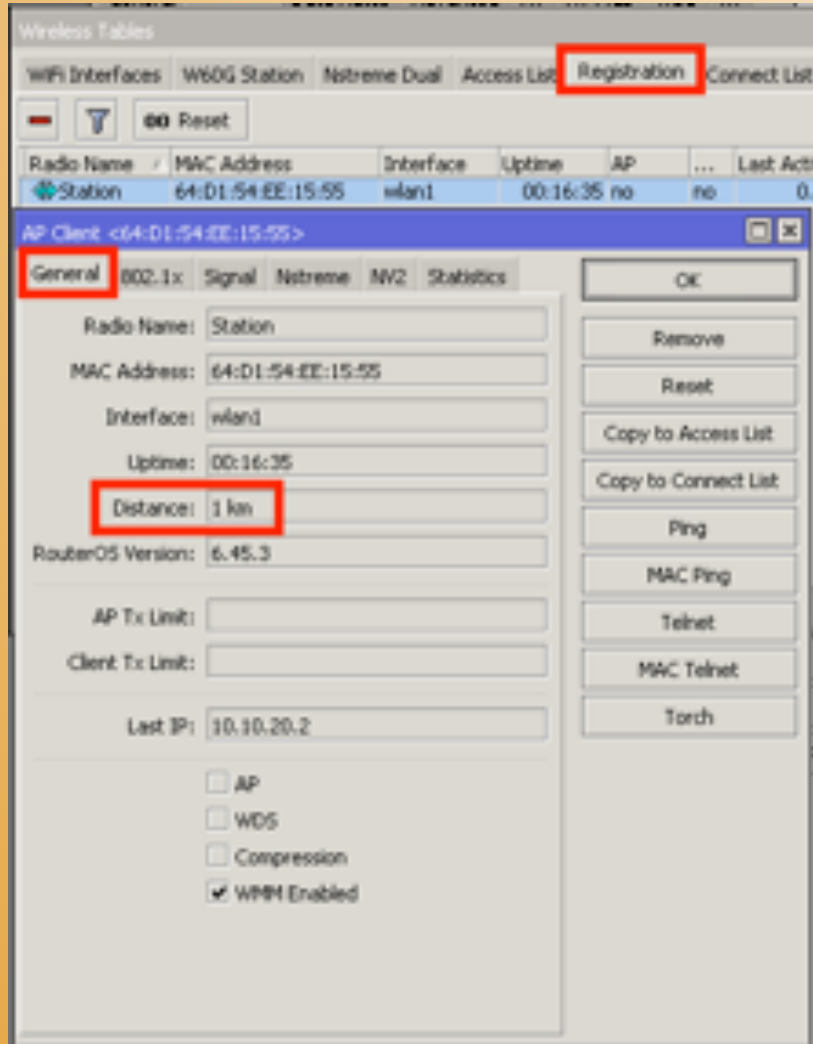
The right window is titled 'Bandwidth Test (Running)'. It shows test parameters: Test To: 10.10.20.2, Protocol: udp, Direction: receive (highlighted with a red box). Test results show: Lost Packets: 4931, Tx/Rx Current: 0 bps/109.2 Mbps, Tx/Rx 10s Average: 0 bps/109.3 Mbps, Tx/Rx Total Average: 0 bps/107.7 Mbps. A bar chart at the bottom shows Tx at 0 bps and Rx at 109.2 Mbps.



# Registration Table, General

# Registration Table, General

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# Registration Table, General

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Is this indoor/outdoor

1. Indoor:
2. Outdoor:
  1. Longer → Latency
  2. Shorter → Retransmission

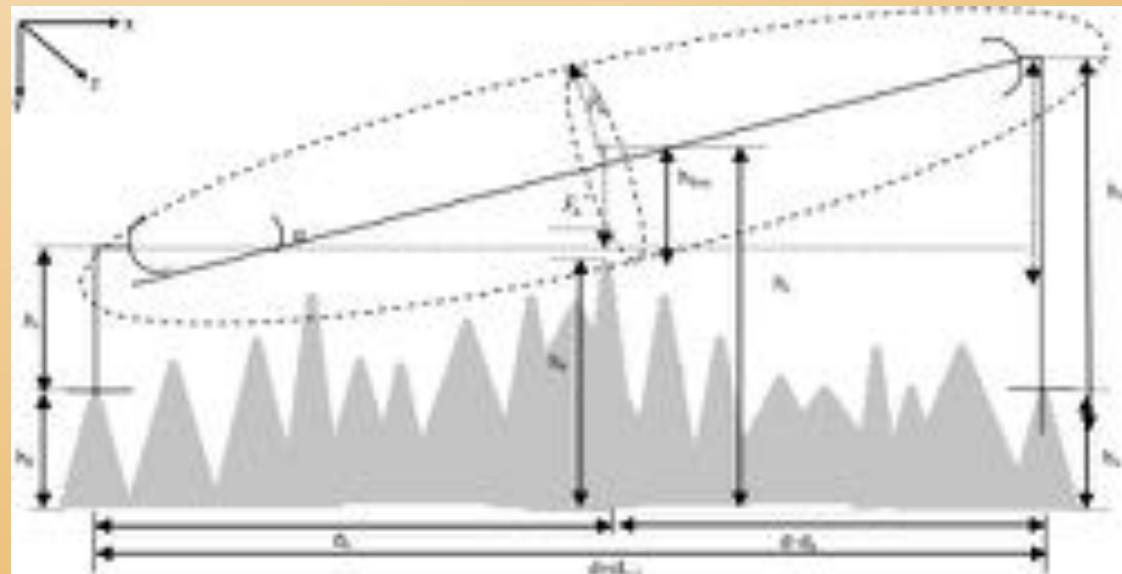
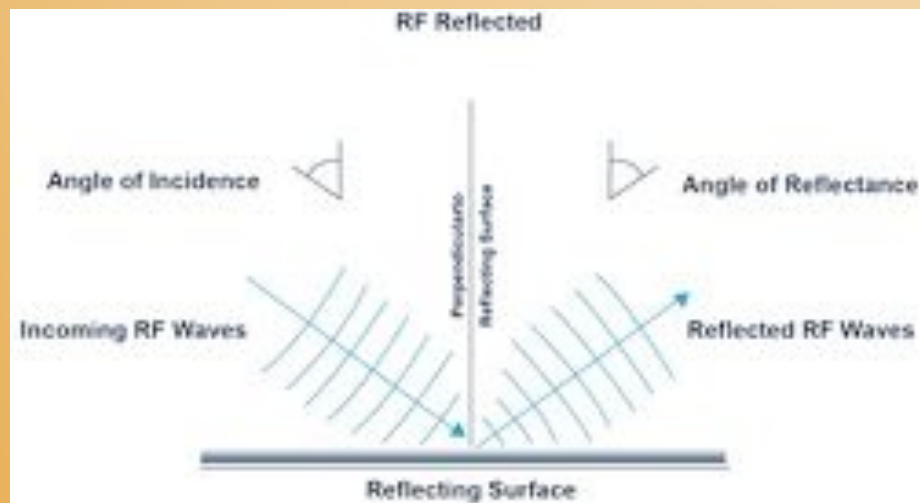
The screenshot shows the Mikrotik WinBox interface. The left sidebar lists various network settings. The main window displays the configuration for the wireless interface 'wlan1'. The 'Advanced' tab is selected, showing settings like 'Max Station Count' (2007), 'Distance' (dynamic), 'Burst Time' (indoors), and 'Hw. Retries' (7). A red '3' is placed over the 'Advanced' tab. Below this, the 'Registration' tab is active, showing a table of registered stations. A red '2' is placed over the 'Registration' tab. The table lists a station with MAC address '64:D1:54:EE:15:55' on interface 'wlan1'. A red '3' is placed over the station name. Below the table, the 'AP Client' configuration is shown, with a red '4' placed over the 'Statistics' tab. A red arrow labeled 'Compare' points from the 'AP Client' statistics to the 'Registration' table.

| Radio Name | MAC Address       | Interface | Uptime      | AP | Last Ac |
|------------|-------------------|-----------|-------------|----|---------|
| Station 3  | 64:D1:54:EE:15:55 | wlan1     | 6d 01:19... | no | no      |

| General                | 802.1x | Signal | Nstreme | NV2 | Statistics 4         |
|------------------------|--------|--------|---------|-----|----------------------|
| Tx Rate:               |        |        |         |     | 400Mbps-409kb/25/5G1 |
| Rx Rate:               |        |        |         |     | 6Mbps                |
| Tx/Rx Packets:         |        |        |         |     | 38/3                 |
| Tx/Rx Bytes:           |        |        |         |     | 509 B/407 B          |
| Tx/Rx Frames:          |        |        |         |     | 38/4                 |
| Tx/Rx Frame Bytes:     |        |        |         |     | 813 B/496 B          |
| Tx/Rx Hw. Frames:      |        |        |         |     | 38/41                |
| Tx/Rx Hw. Frame Bytes: |        |        |         |     | 1725 B/2913 B        |

# Installation process

1. Fresnel zone and Hight
2. Antenna gain
3. Antenna alignment

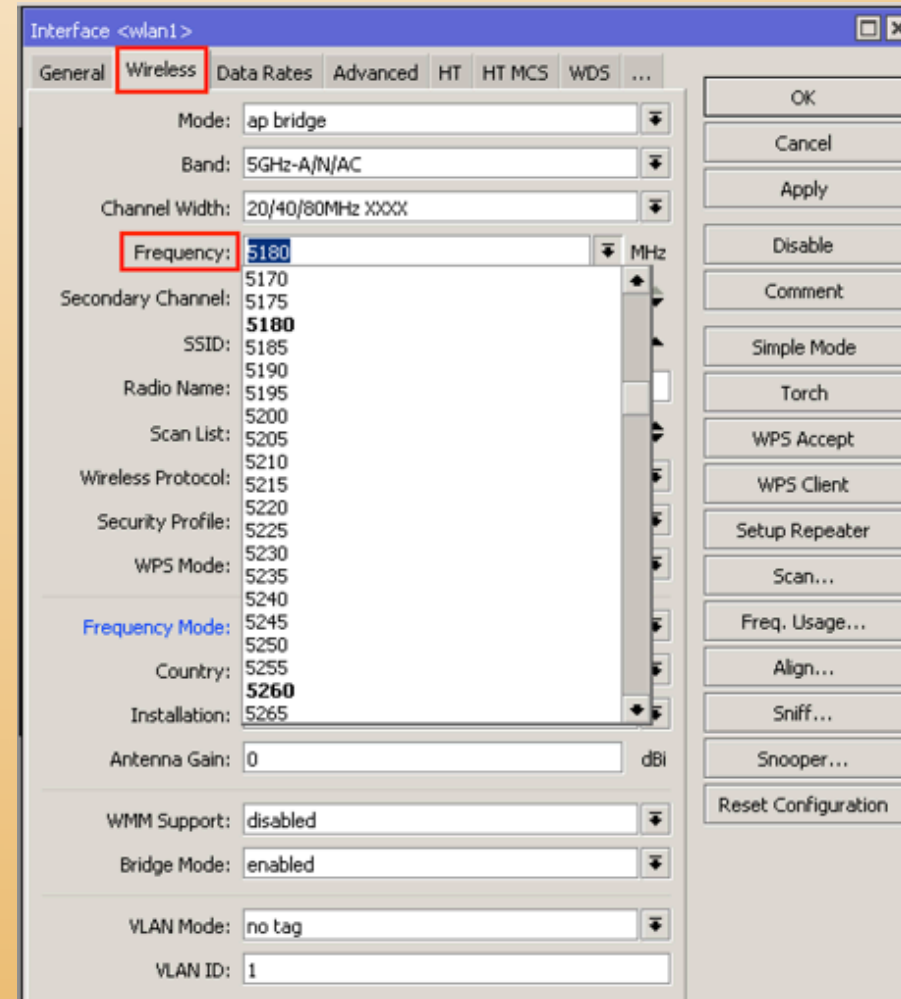


# RouterOS Best configuration

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## Solution

1. Interference
  1. Change frequency
  2. Lower down the Band/Channel width
  3. Lower down the basic data-rate
2. Advanced--> adaptive noise immunity

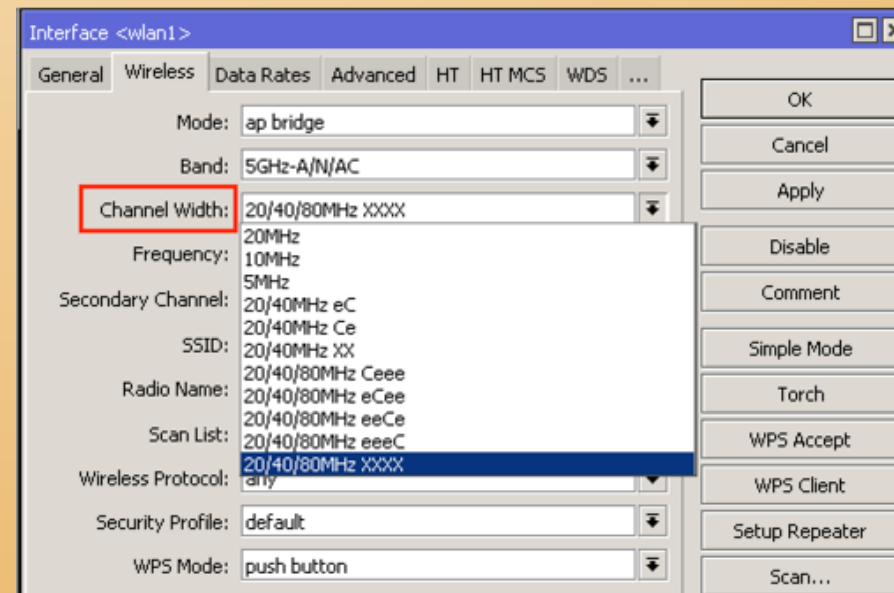
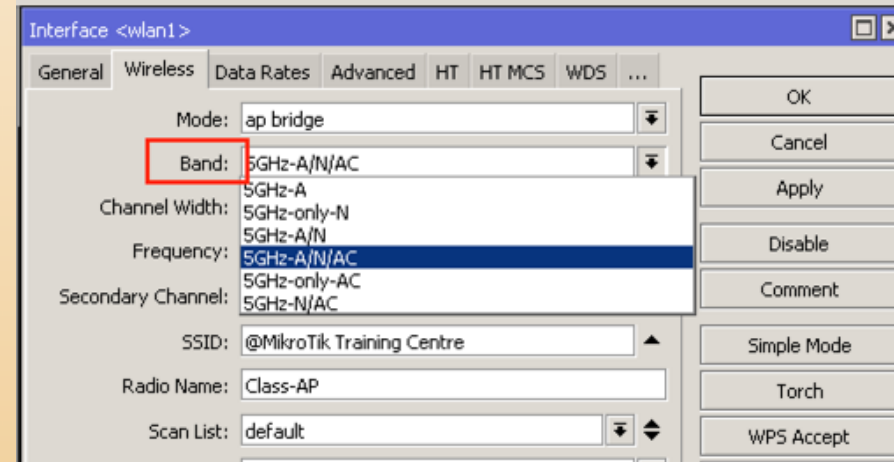


# RouterOS Best configuration

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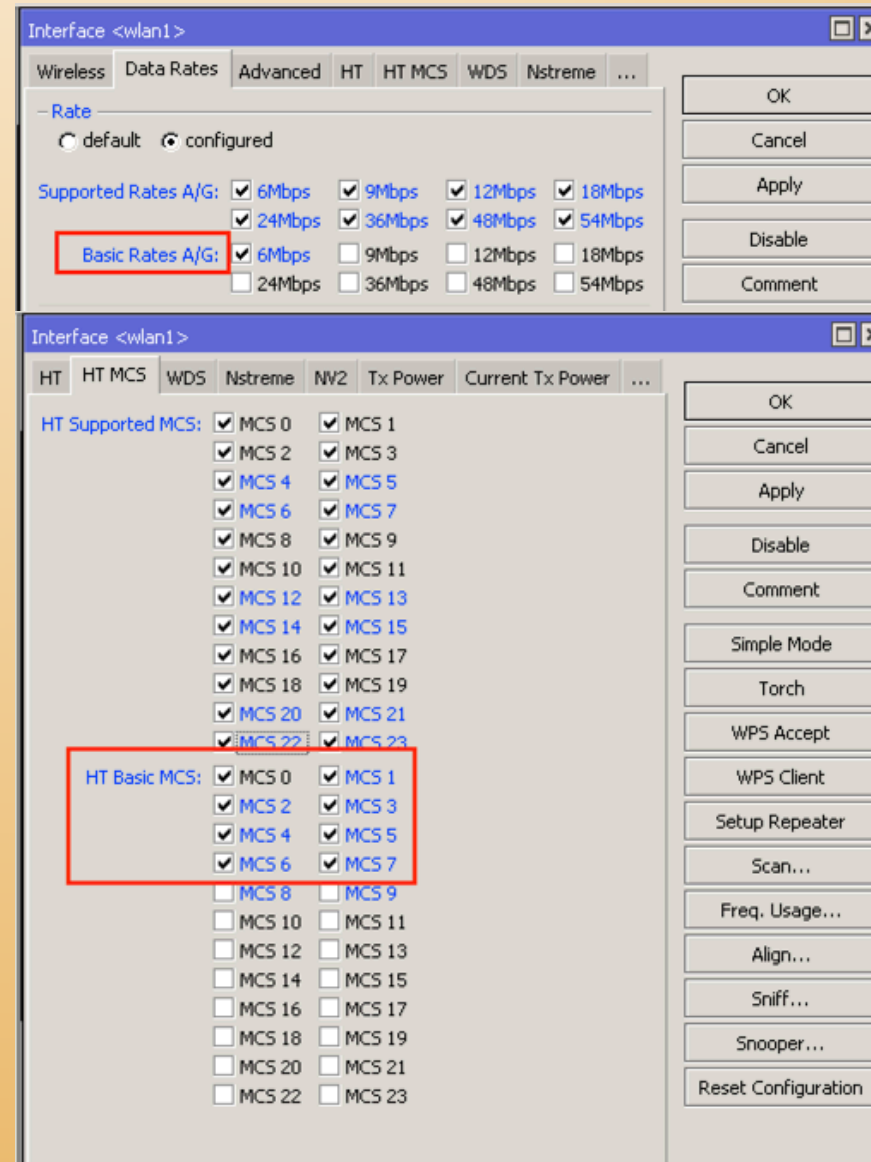


# RouterOS Best configuration

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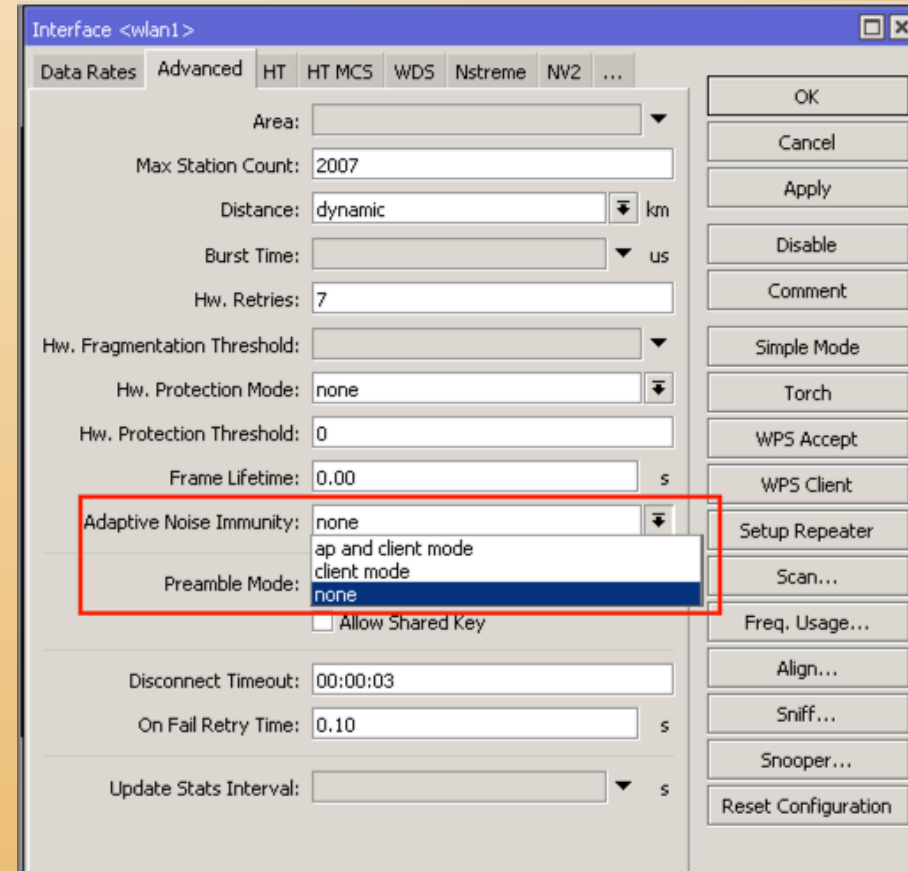


# RouterOS Best configuration

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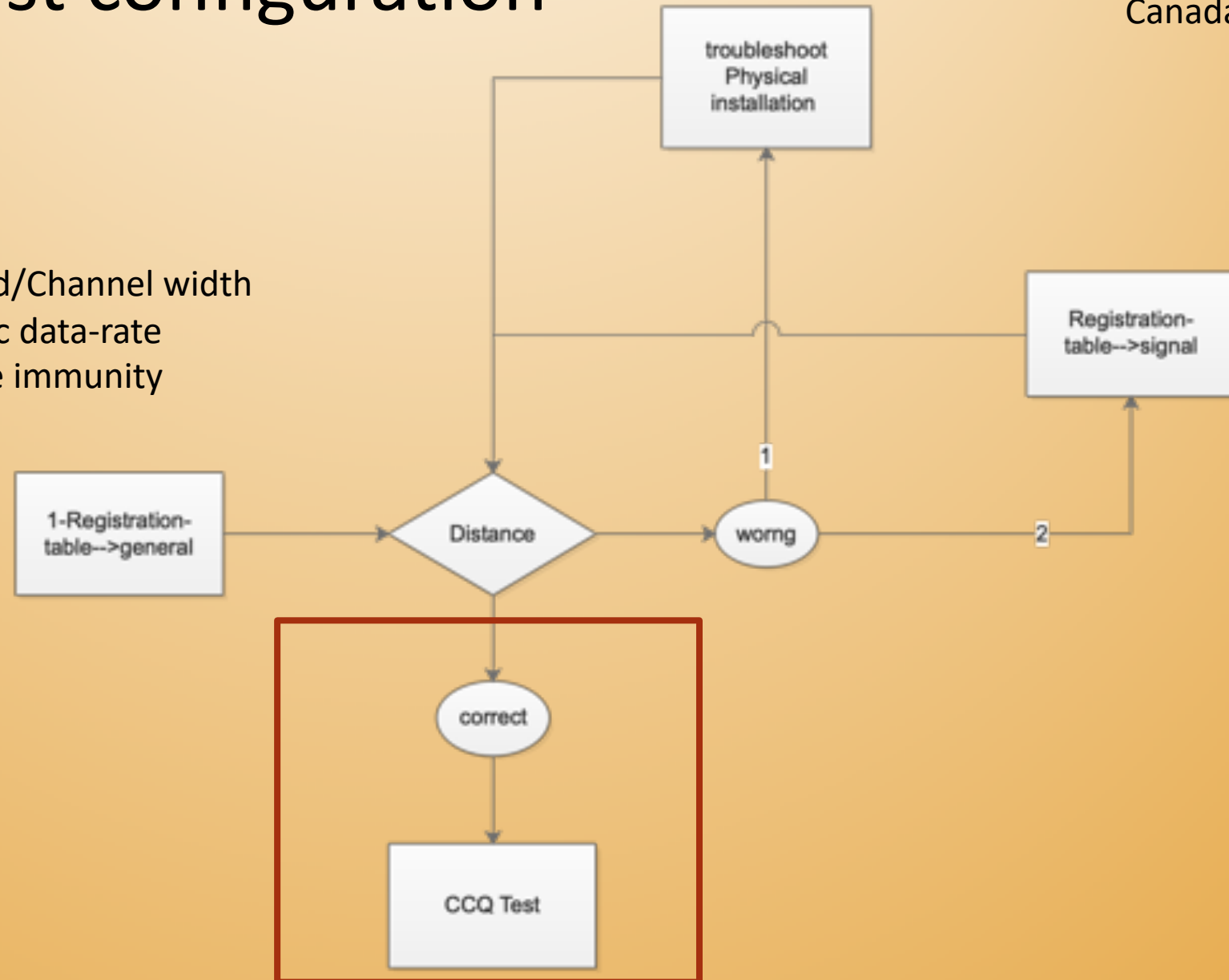


# RouterOS Best configuration

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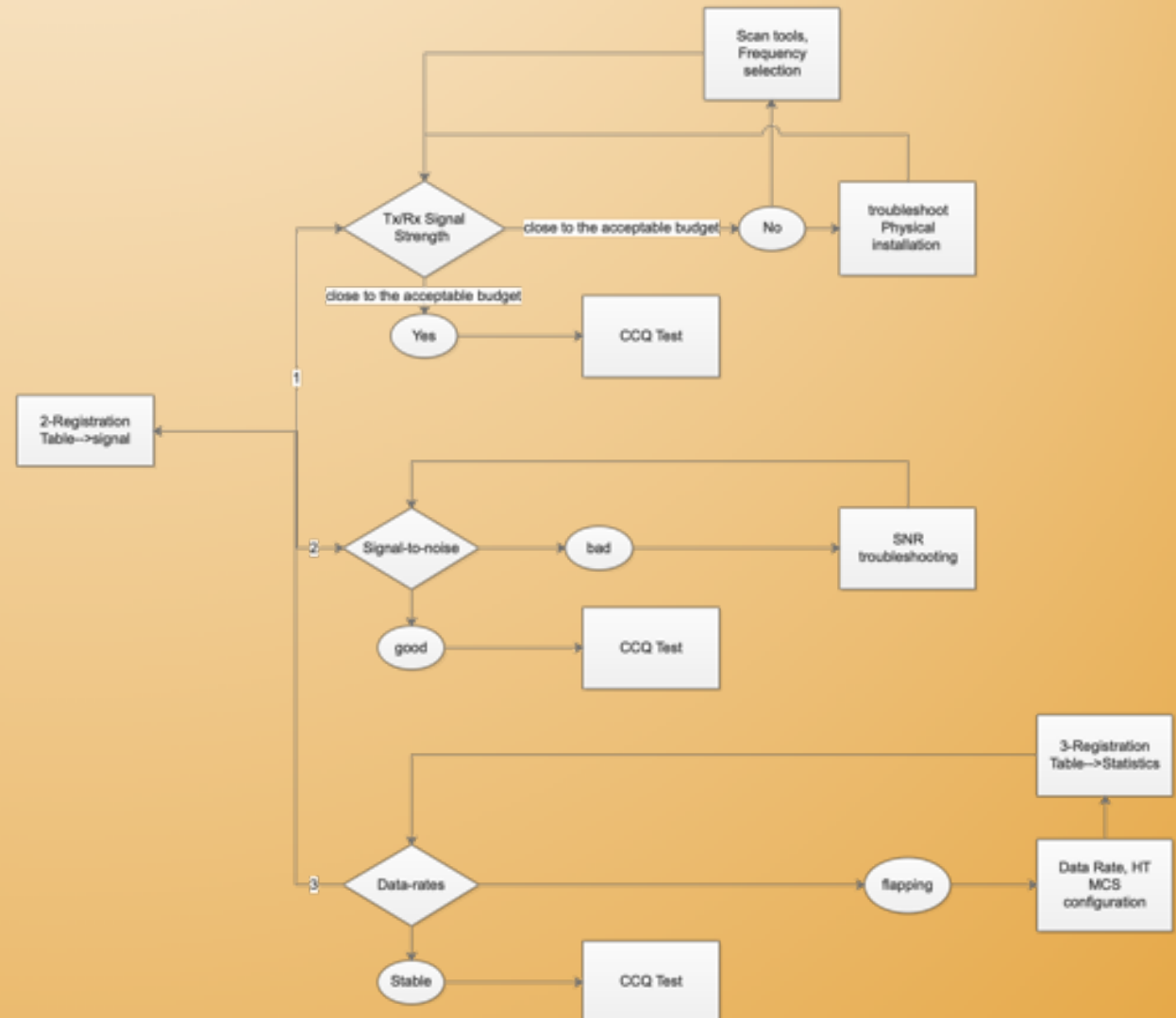


# Registration Table, Signal

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The screenshot shows the Mikrotik WinBox interface. On the left is a sidebar with various network configuration options. The main window is titled 'Wireless Tables' and has several tabs: 'WIFI Interfaces', 'W60G Station', 'Nstreme Dual', 'Access List', 'Registration', and 'Connect List'. The 'Registration' tab is active, showing a table with one entry: 'Station' with MAC address '64:D1:54:EE:15:55' and interface 'wlan1'. Below this is a sub-window for 'AP Client <64:D1:54:EE:15:55>' with tabs for 'General', '802.1x', 'Signal', 'Nstreme', 'NV2', and 'Statistics'. The 'Signal' tab is selected, showing various signal strength metrics and a 'Signal Strengths' table.

| Rate   | Strength | Last Measured  |
|--------|----------|----------------|
| 54Mbps | -27      | 6d 00:46:13.22 |
| 48Mbps | -26      | 6d 01:15:13.21 |
| 36Mbps | -24      | 6d 01:26:30.65 |
| 6Mbps  | -23      | 00:00:01.01    |
| 9Mbps  | -23      | 6d 02:04:13.22 |
| 12Mbps | -23      | 6d 01:52:13.22 |
| 24Mbps | -23      | 6d 01:34:13.21 |
| 18Mbps | -22      | 6d 01:43:13.21 |



# Registration Table, Signal

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AP Client <64:D1:54:EE:15:55>

General 802.1x Signal Nstreme NV2 Statistics

Last Activity: 0.970 s

Tx/Rx Signal Strength: -21/-23 dBm

Tx/Rx Signal Strength Ch0: -24/-33 dBm

Tx/Rx Signal Strength Ch1: -24/-23 dBm

Tx/Rx Signal Strength Ch2:

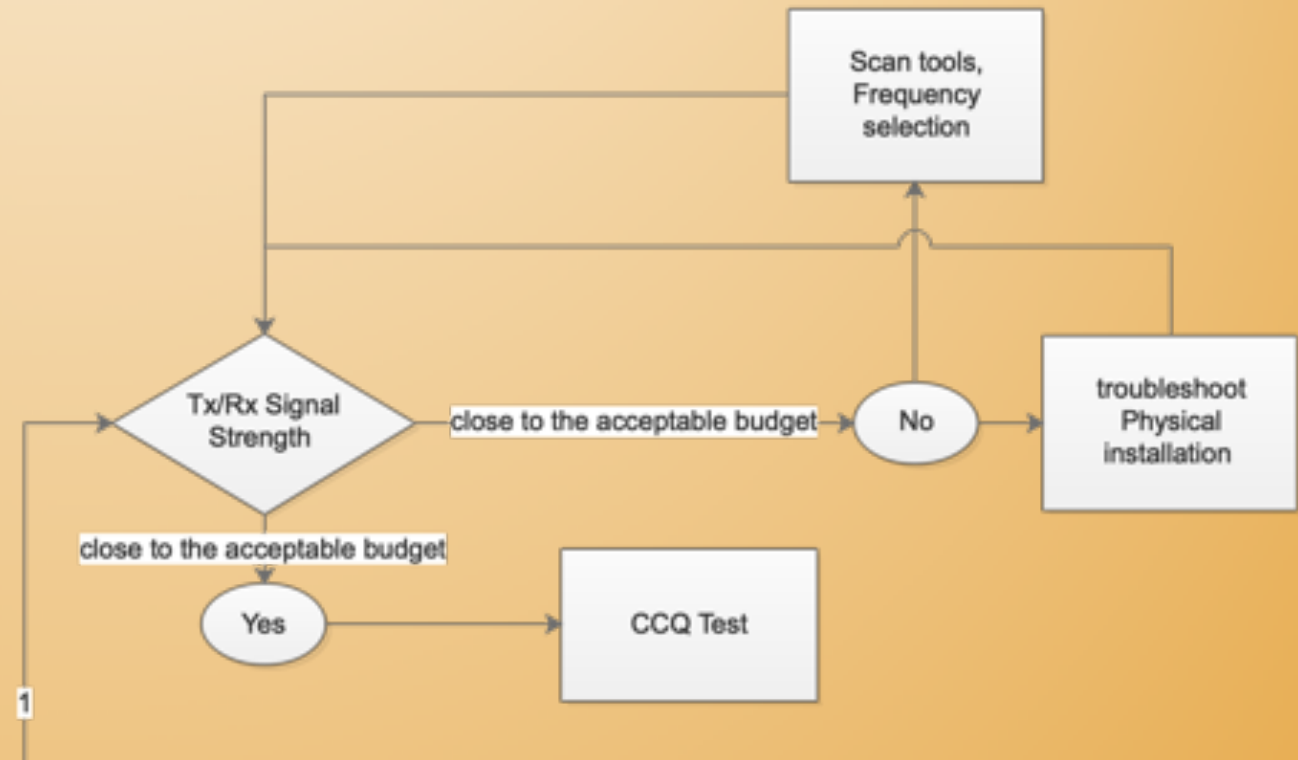
Signal To Noise: 79 dB

Tx/Rx CCQ: 71/66 %

P Throughput: 352200 kbps

Signal Strengths

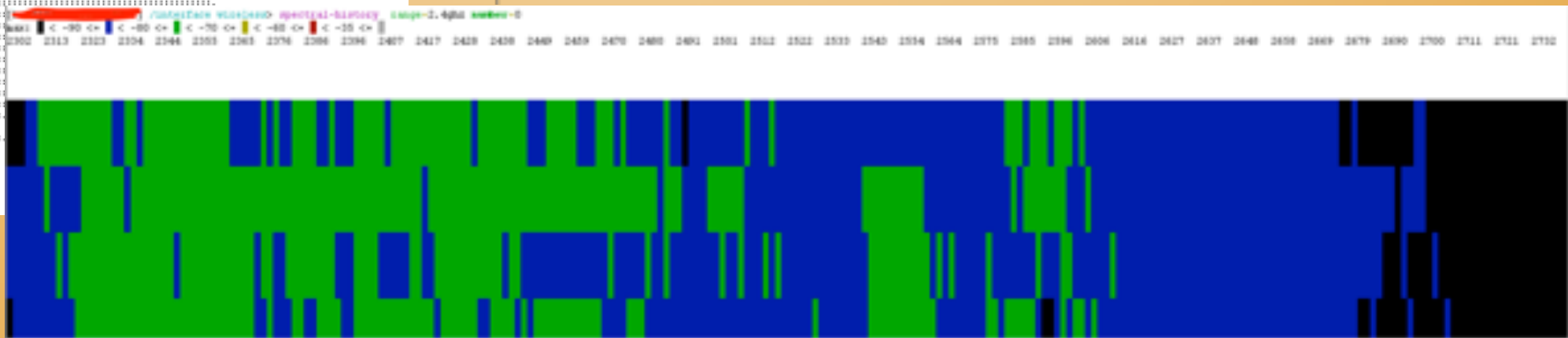
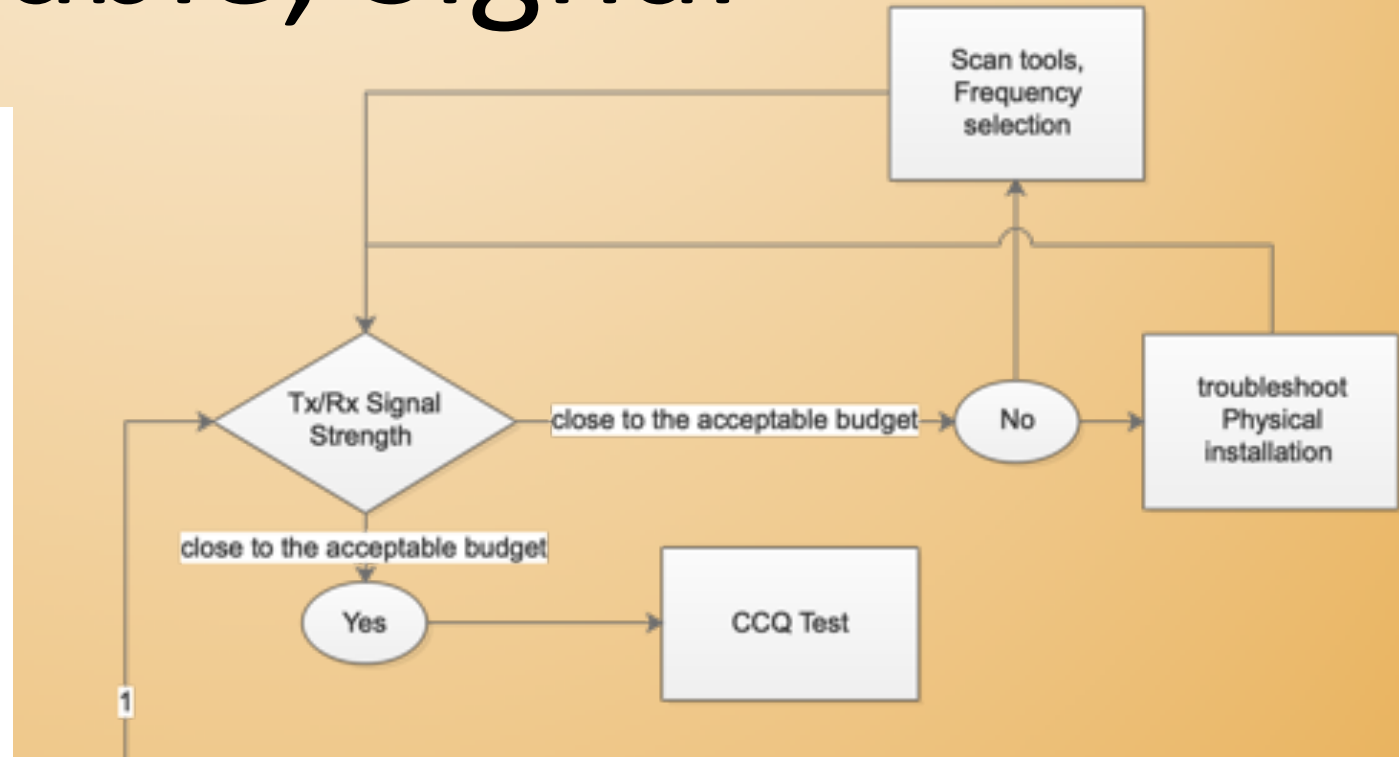
| Rate   | Strength | Last Measured  |
|--------|----------|----------------|
| 54Mbps | -27      | 6d 00:59:31.18 |
| 48Mbps | -26      | 6d 01:28:31.17 |
| 36Mbps | -24      | 6d 01:39:48.61 |
| 6Mbps  | -23      | 00:00:00.97    |
| 9Mbps  | -23      | 6d 02:17:31.18 |
| 12Mbps | -23      | 6d 02:05:31.18 |
| 24Mbps | -23      | 6d 01:47:31.17 |
| 18Mbps | -22      | 6d 01:56:31.17 |



# Registration Table, Signal

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```
interface wireless> spectral-scan range=2.4ghz number=0
FREQ DBM GRAPH
2305 -80 .....
2312 -78 .....
2319 -80 .....
2326 -76 .....
2333 -76 .....
2340 -76 .....
2340 -77 .....
2355 -76 .....
2361 -75 .....
2369 -77 .....
2376 -77 .....
2383 -76 .....
2390 -76 .....
2397 -72 .....
2404 -79 .....
2411 -73 .....
2418 -75 .....
2425 -74 .....
2433 -73 .....
2440 -77 .....
2447 -78 .....
2454 -78 .....
2461 -76 .....
2468 -77 .....
2475 -82 .....
2482 -83 .....
2489 -83 .....
2496 -86 .....
2504 -79 .....
2511 -80 .....
2518 -81 .....
2525 -83 .....
2532 -80 .....
2539 -80 .....
2546 -81 .....
2553 -81 .....
2560 -82 .....
2568 -83 .....
2575 -86 .....
2581 -81 .....
2589 -81 .....
2596 -78 .....
2603 -77 .....
2610 -79 .....
2617 -81 .....
2624 -81 .....
2631 -82 .....
2638 -84 .....
2645 -84 .....
2653 -84 .....
2660 -85 .....
2667 -87 .....
2674 -87 .....
2681 -89 .....
2688 -90 .....
2695 -89 .....
2702 -91 .....
2709 -92 .....
2716 -93 .....
2724 -94 .....
2731 -95 .....
2738 -97 .....
```



# Registration Table, Signal

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Scanner (Running)

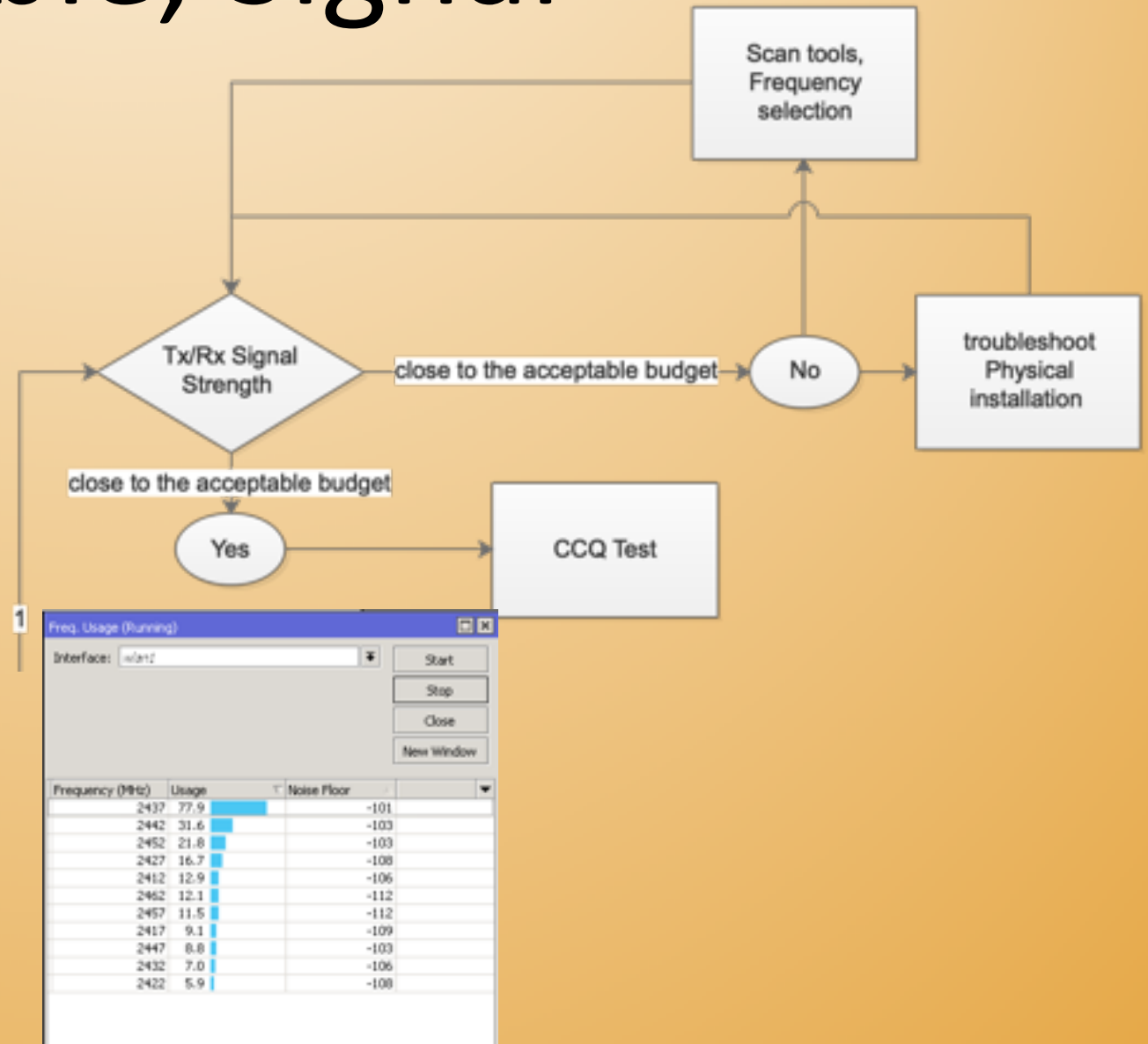
Interface: wlan1

Background Scan

Start  
Stop  
Close  
Connect  
New Window

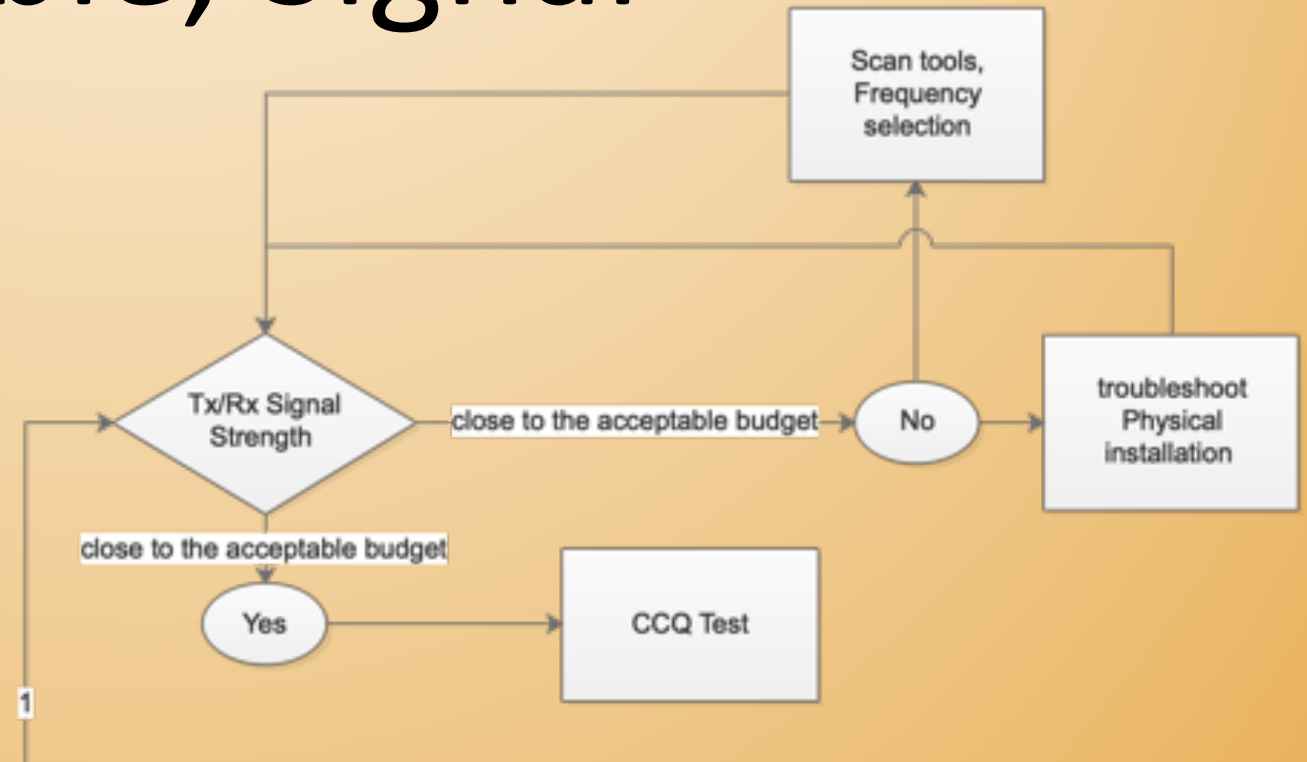
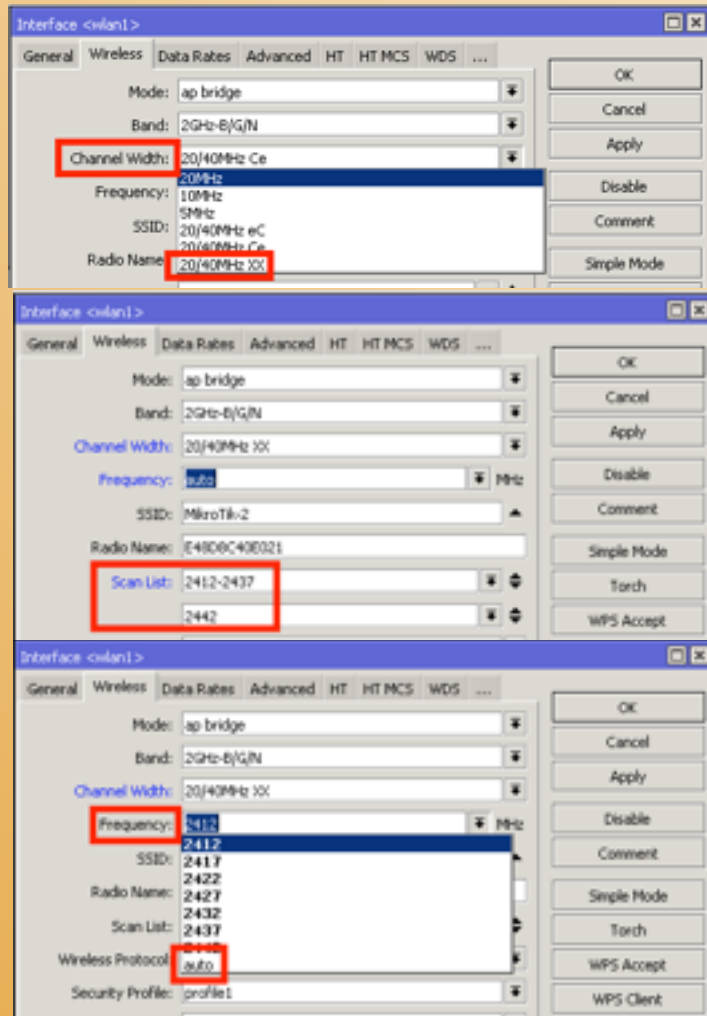
| AP | Address | SSID        | Channel  | Signal Strength | Noise Floor | Signal To Noise | Radio Name | Router... |
|----|---------|-------------|----------|-----------------|-------------|-----------------|------------|-----------|
| AP |         | ASUS        | 2412/... | -83             | -107        | 24              |            |           |
| AP |         | MikroTik-2  | 2412/... | -76             | -107        | 31              |            |           |
| AP |         | BOODCO...   | 2412/... | -79             | -107        | 28              |            | 6.45.6    |
| AP |         | BeaverK...  | 2412/... | -89             | -107        | 18              |            |           |
| AP |         | ym          | 2422/... | -87             | -110        | 23              |            |           |
| AP |         | HomeNe...   | 2422/... | -83             | -110        | 27              |            |           |
| P  |         | Yoo Wire... | 2422/... | -86             | -110        | 24              |            |           |
| AP |         | MikroTik-2  | 2437/... | -82             | -101        | 19              |            | 6.45.6    |
| AP |         | Jogau       | 2437/... | -85             | -101        | 16              |            |           |
| AP |         | BELL451     | 2437/... | -88             | -101        | 13              |            |           |
| AP |         |             | 2437/... | -86             | -101        | 15              |            |           |
| AP |         | dink-5858   | 2437/... | -92             | -101        | 9               |            |           |
| AP |         |             | 2437/... | -85             | -101        | 16              |            |           |
| AP |         | Dong        | 2462/... | -73             | -112        | 39              |            |           |
| AP |         | PRINCE      | 2462/... | -89             | -112        | 23              |            |           |
| AP |         |             | 2462/... | -76             | -112        | 36              |            |           |
| P  |         | CPRECT...   | 2462/... | -87             | -112        | 25              |            |           |
| AP |         | Cooladrien  | 2462/... | -84             | -112        | 28              |            |           |
| AP |         |             | 2462/... | -82             | -112        | 30              |            |           |
| AP |         | Abby        | 2462/... | -85             | -112        | 27              |            |           |
| AP |         | U-Bell      | 2412/... | -85             | -107        | 22              |            |           |
| AP |         | CPRECT...   | 2412/... | -82             | -107        | 25              |            |           |
| AP |         | BELL168     | 2412/... | -91             | -107        | 16              |            |           |
| AP |         |             | 2412/... | -90             | -107        | 17              |            |           |
| AP |         |             | 2412/... | -90             | -107        | 17              |            |           |
| P  |         | PRINCE-G    | 2412/... | -91             | -107        | 16              |            |           |
| AP |         | BELL168     | 2437/... | -86             | -101        | 15              |            |           |
| AP |         | Yoo Inte... | 2437/... | -91             | -101        | 10              |            |           |
| AP |         | CPRECT...   | 2462/... | -96             | -112        | 16              |            |           |
| AP |         | Abby        | 2462/... | -77             | -112        | 35              |            |           |
| AP |         |             | 2462/... | -85             | -112        | 27              |            |           |
| AP |         |             | 2462/... | -80             | -112        | 32              |            |           |

56 items



# Registration Table, Signal

MUM  
Canada, 2019





# Registration Table, Signal

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Canada, 2019

AP Client <64:D1:54:EE:15:55>

General 802.1x Signal Nstreme NV2 Statistics

Last Activity: 1.000 s

Tx/Rx Signal Strength: -22/-22 dBm

Tx/Rx Signal Strength Ch0: -25/-34 dBm

Tx/Rx Signal Strength Ch1: -25/-22 dBm

Tx/Rx Signal Strength Ch2:

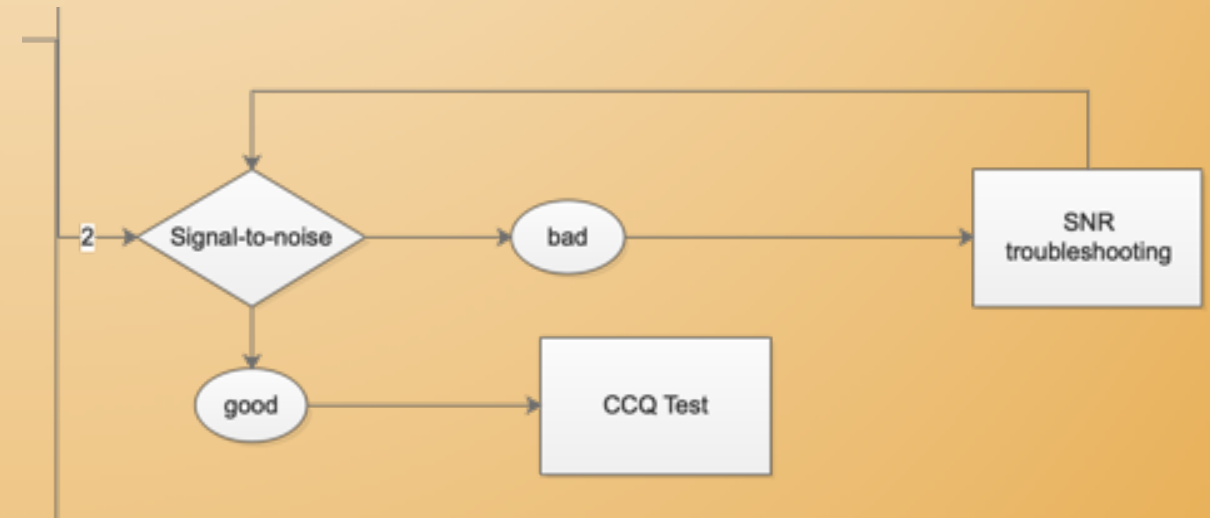
**Signal To Noise: 79 dB**

Tx/Rx CCQ: 70/71 %

P Throughput: 349620 kbps

Signal Strengths

| Rate   | Strength | Last Measured  |
|--------|----------|----------------|
| 54Mbps | -27      | 6d 13:10:06.64 |
| 48Mbps | -26      | 6d 13:39:06.63 |
| 36Mbps | -24      | 6d 13:50:24.07 |
| 9Mbps  | -23      | 6d 14:28:06.64 |
| 12Mbps | -23      | 6d 14:16:06.64 |
| 24Mbps | -23      | 6d 13:58:06.63 |
| 6Mbps  | -22      | 00:00:01       |
| 18Mbps | -22      | 6d 14:07:06.63 |



If the peak of an RF signal is somewhere near the noise floor, the receiver may confuse the data signal with noise and result in Data-rate flapping.

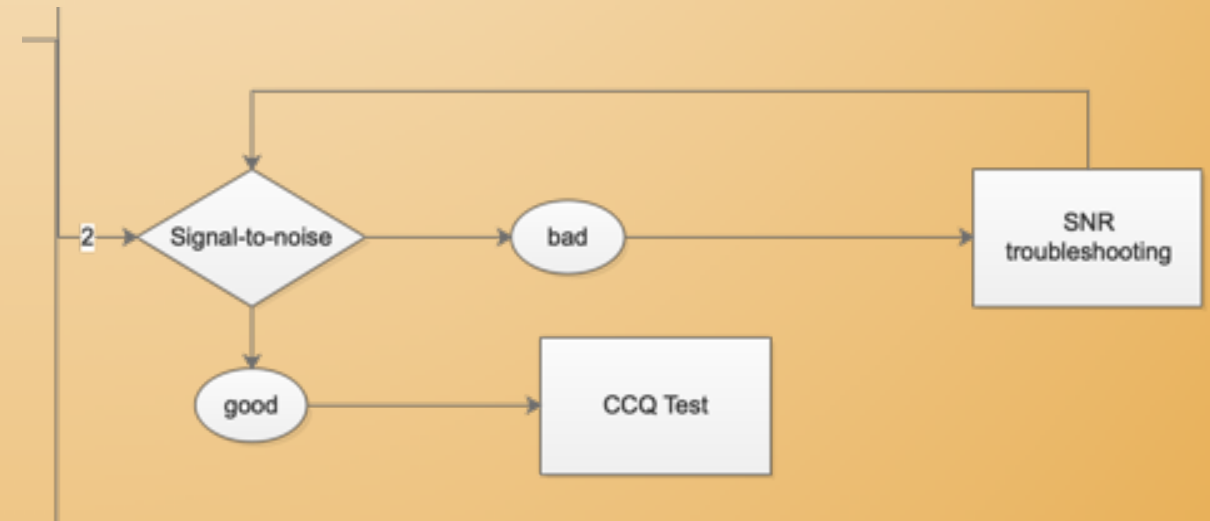
Many experts agree that an SNR measurement of 22 dB or more is a viable RF link, but there is no hard and fast rule for this measurement.



# Registration Table, Signal

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The image shows two screenshots from Mikrotik WinBox. The top screenshot is the 'Interface <wlan1>' configuration window. It displays various parameters: Last Link Down Time (Sep/15/2019 22:45:10), Last Link Up Time (Sep/15/2019 22:45:10), Link Downs (73), Channel (5180/20-Ceee/ac), Registered Clients (1), Authenticated Clients (1), Overall Tx CCQ (69%), and Distance (1 km). The 'Noise Floor' is highlighted with a red circle and set to -101 dBm. The bottom screenshot is the 'AP Client <CC:2D:ED:EA-AA:10>' window, showing 'Tx Rate: 18Mbps' and 'Rx Rate: 1Mbps' highlighted with a red box. Other statistics include Tx/Rx Packets, Bytes, and Frames.



If the peak of an RF signal is somewhere near the noise floor, the receiver may confuse the data signal with noise and result in Data-rate flapping.

Many experts agree that an SNR measurement of 22 dB or more is a viable RF link, but there is no hard and fast rule for this measurement.

# Registration Table, Signal

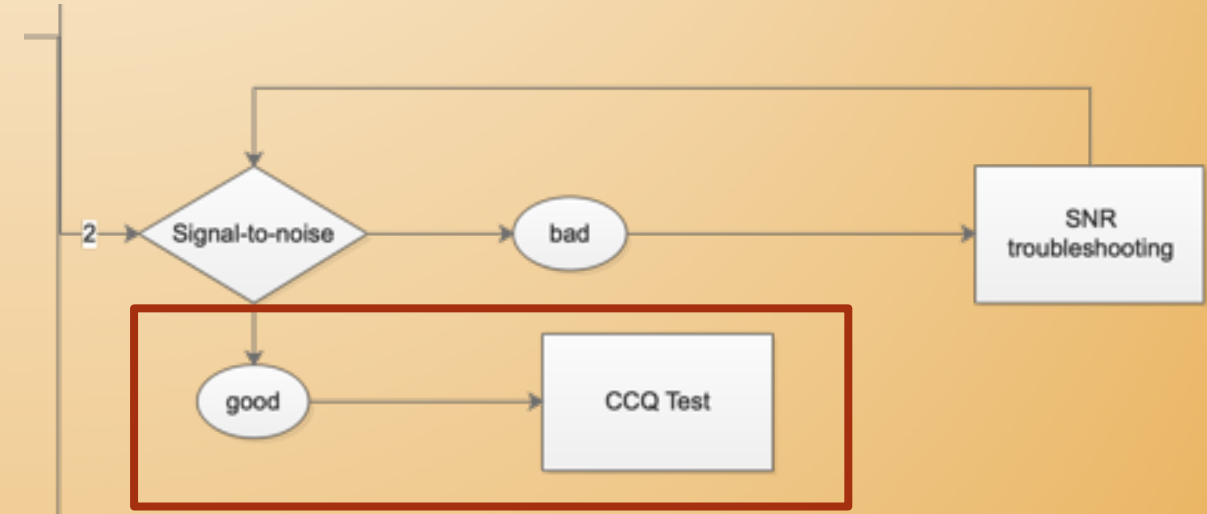
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Interface < wlan1 >

WDS Nbtreme MV2 Tx Power Current Tx Power Status Traffic ...

Current Tx Powers

| Rate    | Tx Power | Total ... |
|---------|----------|-----------|
| 1Mbps   | 19dBm    | 22dBm     |
| 2Mbps   | 19dBm    | 22dBm     |
| 5.5Mbps | 19dBm    | 22dBm     |
| 11Mbps  | 19dBm    | 22dBm     |
| 6Mbps   | 17dBm    | 20dBm     |
| 9Mbps   | 17dBm    | 20dBm     |
| 12Mbps  | 17dBm    | 20dBm     |
| 18Mbps  | 17dBm    | 20dBm     |
| 24Mbps  | 17dBm    | 20dBm     |
| 36Mbps  | 17dBm    | 20dBm     |
| HT20-0  | 17dBm    | 20dBm     |
| HT20-1  | 17dBm    | 20dBm     |
| HT20-2  | 17dBm    | 20dBm     |
| HT20-3  | 17dBm    | 20dBm     |
| 48Mbps  | 16dBm    | 19dBm     |
| HT20-4  | 16dBm    | 19dBm     |
| HT40-0  | 16dBm    | 19dBm     |
| HT40-1  | 16dBm    | 19dBm     |
| HT40-2  | 16dBm    | 19dBm     |
| HT40-3  | 16dBm    | 19dBm     |
| 54Mbps  | 15dBm    | 18dBm     |
| HT20-5  | 15dBm    | 18dBm     |
| HT40-4  | 15dBm    | 18dBm     |
| HT20-6  | 14dBm    | 17dBm     |
| HT40-5  | 14dBm    | 17dBm     |
| HT20-7  | 13dBm    | 16dBm     |
| HT40-6  | 13dBm    | 16dBm     |
| HT40-7  | 12dBm    | 15dBm     |



Solutions:

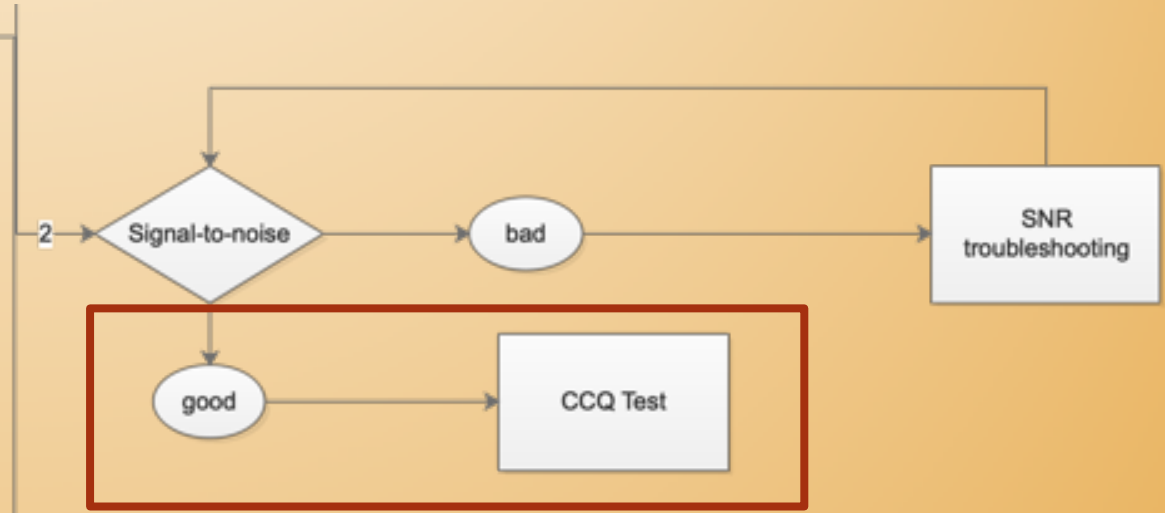
1. Passive gain "Use lower antenna gain"
2. Active gain
  1. Adjust Tx-Power
    1. Changing the Tx-power
    2. Frequency mode and country regulatory
  2. Use appropriated Antenna gain
3. Filter Rx-Sensitivity

# Registration Table, Signal

MUM  
Canada, 2019

The image shows two screenshots from a network management interface. The left screenshot shows the 'Tx Power Mode' dropdown menu with options: 'card rates', 'all rates fixed', 'card rates', 'default', and 'manual'. The right screenshot shows the 'AP Client' configuration window with the 'Signal' tab selected. The 'Signal To Noise' value is highlighted as 28 dB. Below this, a table shows signal strengths for various data rates.

| Rate    | Strength | Last Measured |
|---------|----------|---------------|
| 2Mbps   | -79      | 00:23:06.28   |
| 11Mbps  | -79      | 00:08:06.27   |
| 1Mbps   | -78      | 00:00:00.75   |
| 6Mbps   | -76      | 00:24:30.41   |
| 24Mbps  | -76      | 00:00:06.27   |
| 5.5M... | -75      | 00:22:35.71   |
| 18Mbps  | -75      | 00:01:06.28   |
| 36Mbps  | -75      | 00:00:06.27   |
| 48Mbps  | -75      | 00:14:06.22   |
| 12Mbps  | -73      | 00:01:09.80   |



Solutions:

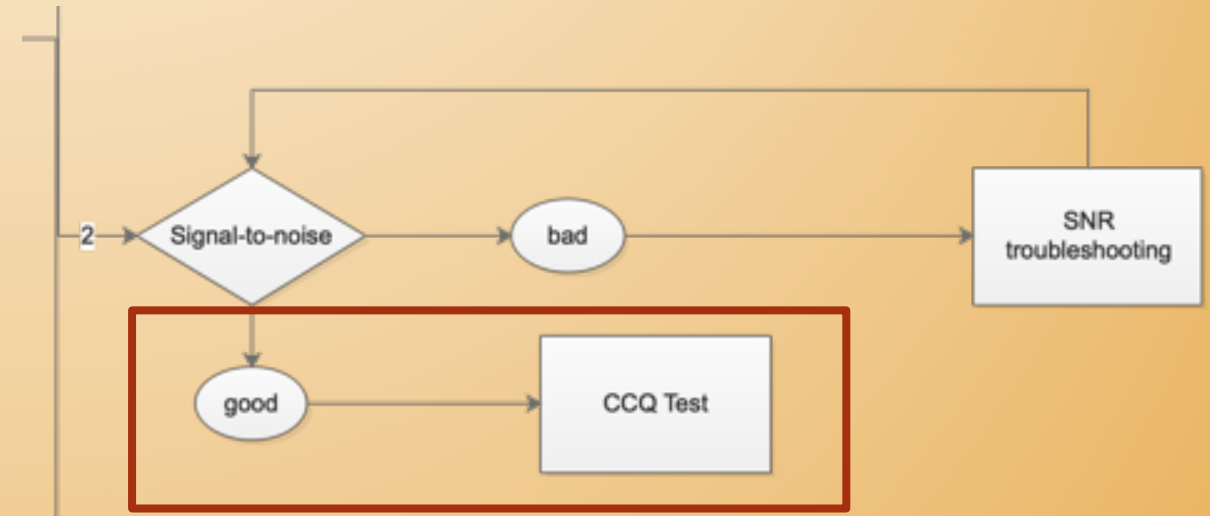
1. Passive gain "Use lower antenna gain"
2. Active gain
  1. Adjust Tx-Power
    1. Changing the Tx-power
    2. Frequency mode and country regulatory
  2. Use appropriated Antenna gain
3. Filter Rx-Sensitivity

# Registration Table, Signal

MUM  
Canada, 2019

The screenshot shows the Mikrotik WinBox interface for configuring a wireless interface. The 'General' tab is active, showing settings for 'Interface <wlan1>'. The 'Signal' tab is also open, displaying signal strength statistics. A red box highlights the 'Signal To Noise: 28 dB' value. Another red box highlights the 'Frequency Mode: regulatory-domain' and 'Country: canada' settings. A blue box highlights the 'Antenna Gain: 20' setting. A blue text overlay at the bottom left reads:  $EIRP = Tx\text{-Power} + Antenna\ Gain - Cable\ loss$ . The 'Signal Strengths' table is also visible, showing various data rates and their corresponding signal strengths.

| Rate    | Strength | Last Measured |
|---------|----------|---------------|
| 2Mbps   | -79      | 00:23:06.28   |
| 11Mbps  | -79      | 00:08:06.27   |
| 1Mbps   | -70      | 00:00:00.75   |
| 6Mbps   | -76      | 00:24:30.41   |
| 24Mbps  | -76      | 00:00:06.27   |
| 5.5M... | -75      | 00:22:35.71   |
| 18Mbps  | -75      | 00:01:06.28   |
| 36Mbps  | -75      | 00:00:06.27   |
| 48Mbps  | -75      | 00:14:06.22   |
| 12Mbps  | -73      | 00:01:09.80   |



Solutions:

1. Passive gain "Use lower antenna gain"
2. Active gain
  1. Adjust Tx-Power
    1. Changing the Tx-power
    2. Frequency mode and country regulatory
  2. Use appropriated Antenna gain
3. Filter Rx-Sensitivity

# Registration Table, Signal

MUM  
Canada, 2019

Interface <client>

Advanced

Max Station Count: 2007

Distance: dynamic km

Noise Floor Threshold: -110

AP Client <CC:2D:ED:EA:AA:82>

Signal

Last Activity: 0.020 s

Tx/Rx Signal Strength: -68/-78 dBm

Tx/Rx Signal Strength Ch0: -78/-81 dBm

Tx/Rx Signal Strength Ch1: -74/-77 dBm

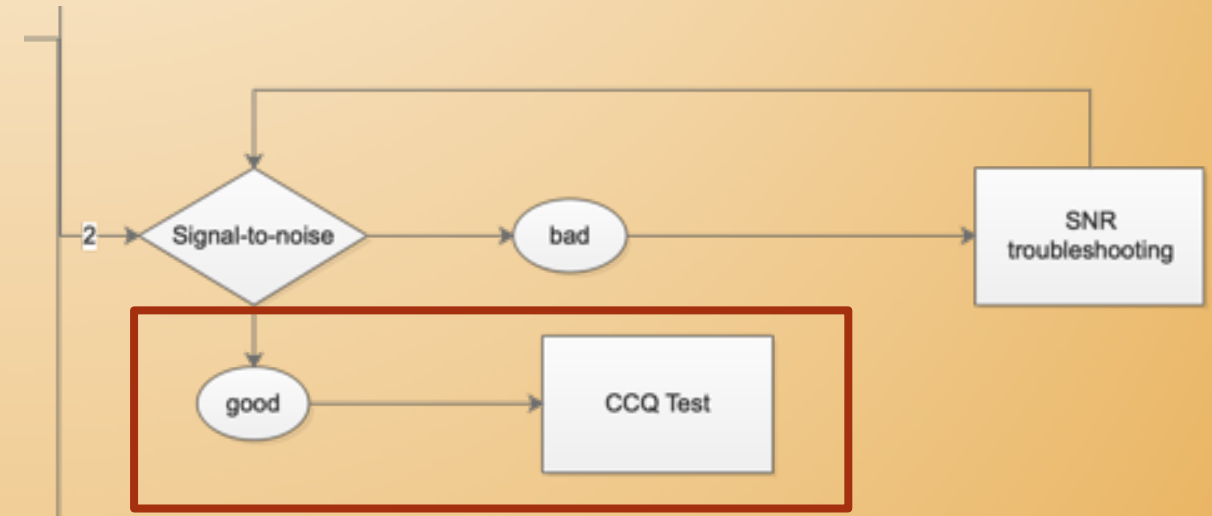
Tx/Rx Signal Strength Ch2:

Signal To Noise: -28 dB

Tx/Rx CCQ: 38/11 %

P Throughput: 13249 kbps

| Rate    | Strength | Last Measured |
|---------|----------|---------------|
| 2Mbps   | -79      | 00:23:06.28   |
| 11Mbps  | -79      | 00:08:06.27   |
| 1Mbps   | -78      | 00:00:00.75   |
| 6Mbps   | -76      | 00:24:30.41   |
| 24Mbps  | -76      | 00:00:06.27   |
| 5.5M... | -75      | 00:22:35.71   |
| 18Mbps  | -75      | 00:01:06.28   |
| 36Mbps  | -75      | 00:00:06.27   |
| 48Mbps  | -75      | 00:14:06.22   |
| 12Mbps  | -73      | 00:01:09.80   |



Solutions:

1. Passive gain “Use lower antenna gain”
2. Active gain
  1. Adjust Tx-Power
    1. Changing the Tx-power
    2. Frequency mode and country regulatory
  2. Use appropriated Antenna gain
3. Filter Rx-Sensitivity

# Registration Table, Signal

MUM  
Canada, 2019

AP Client <64:D1:54:EE:14:FF>

General 802.1x Signal Nstreme NV2 Statistics

Last Activity: 0.000 s

Tx/Rx Signal Strength: -22/-22 dBm

Tx/Rx Signal Strength Ch0: -34/-26 dBm

Tx/Rx Signal Strength Ch1: -23/-25 dBm

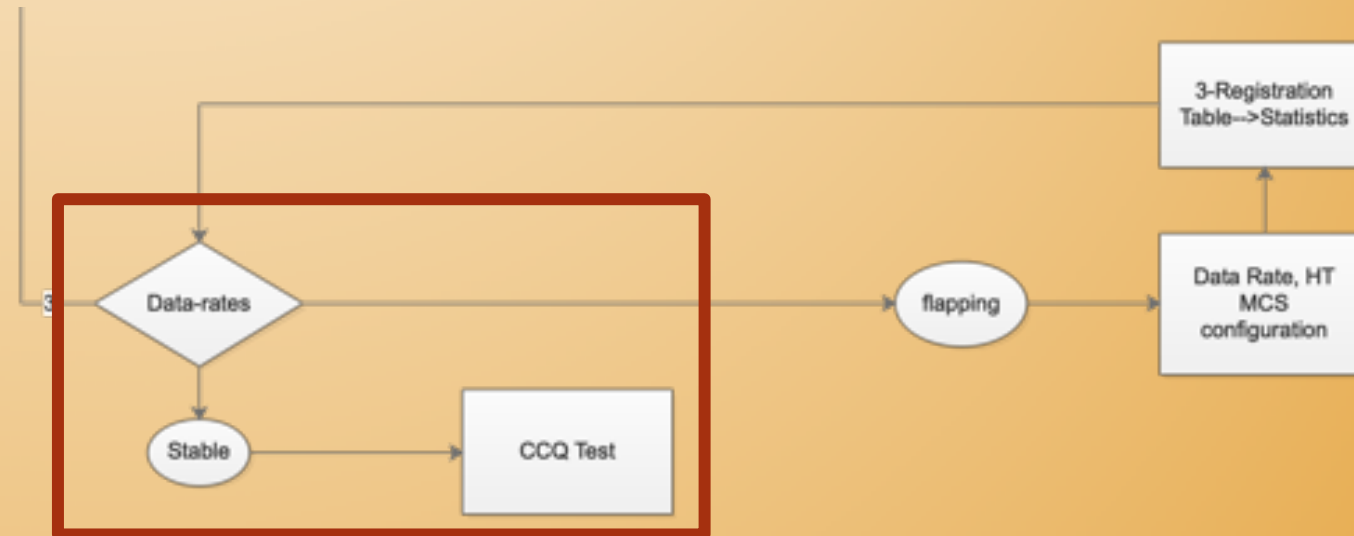
Tx/Rx Signal Strength Ch2:

Signal To Noise: 81 dB

Tx/Rx CCQ: 55/78 %

P Throughput: 295464 kbps

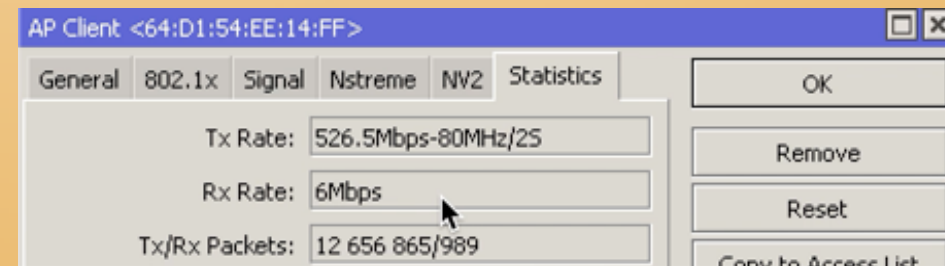
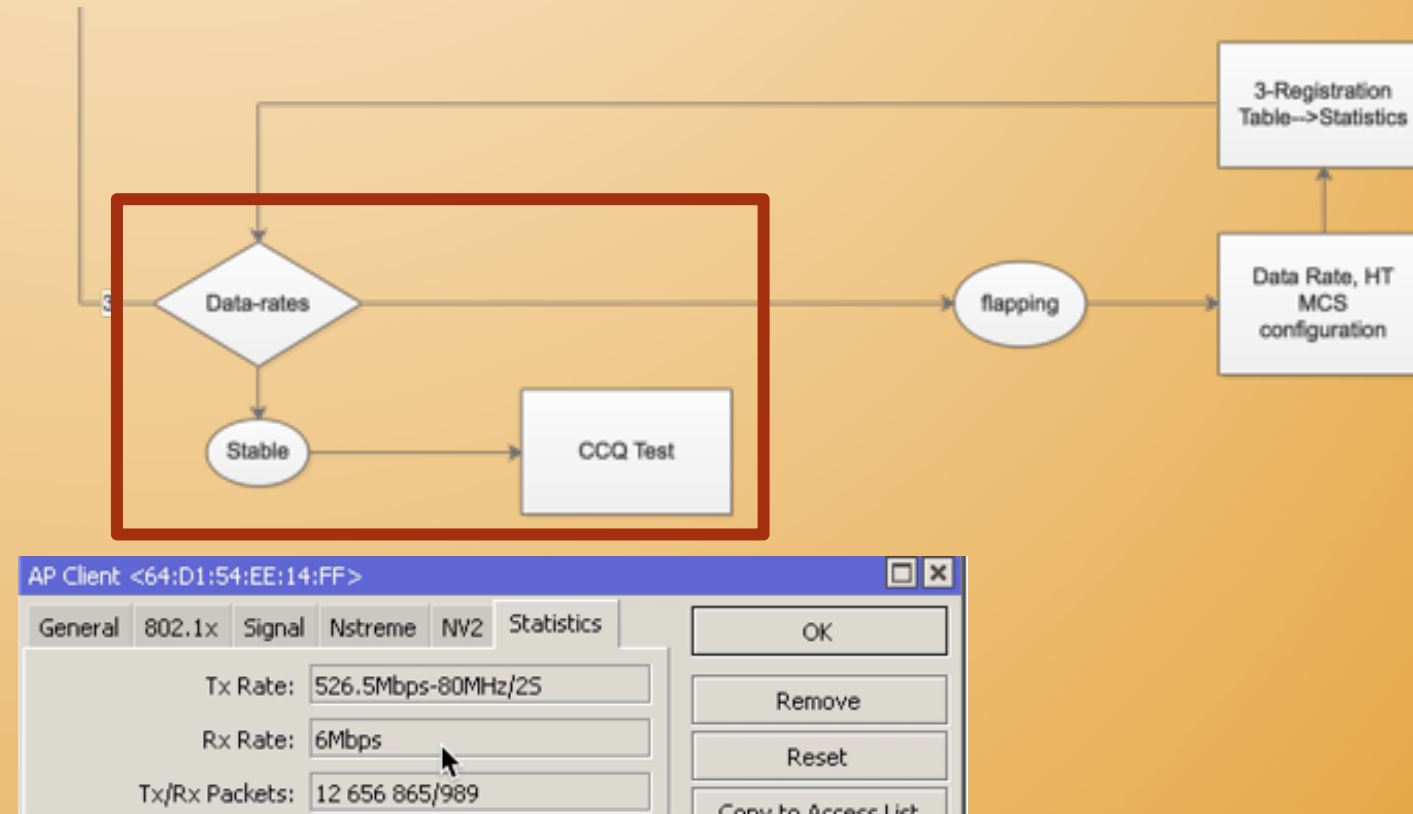
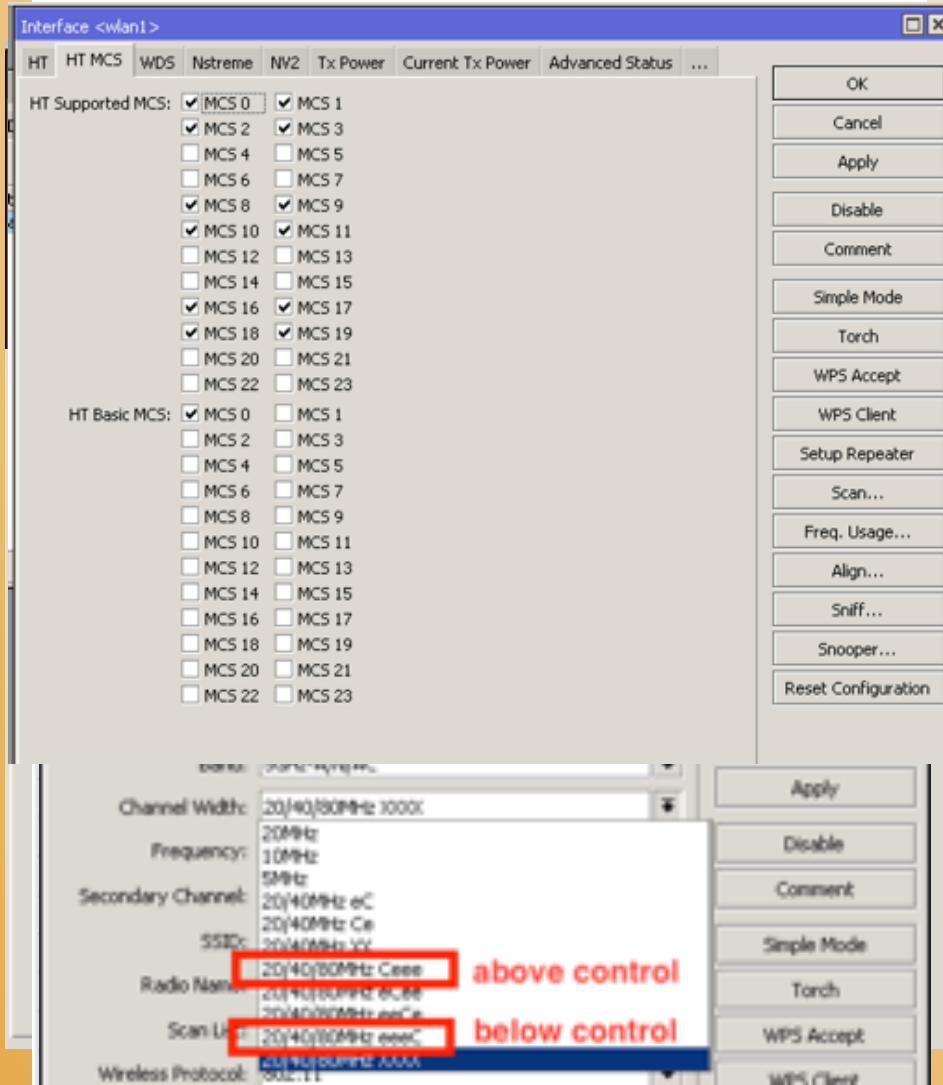
| Rate   | Strength | Last Measured |
|--------|----------|---------------|
| 48Mbps | -23      | 00:00:04.38   |
| 6Mbps  | -22      | 00:00:00.01   |
| 9Mbps  | -22      | 00:01:47.42   |
| 12Mbps | -22      | 00:01:21.42   |
| 18Mbps | -22      | 00:01:02.45   |
| 24Mbps | -22      | 00:00:36.45   |
| 36Mbps | -22      | 00:00:10.43   |





# Registration Table, Signal

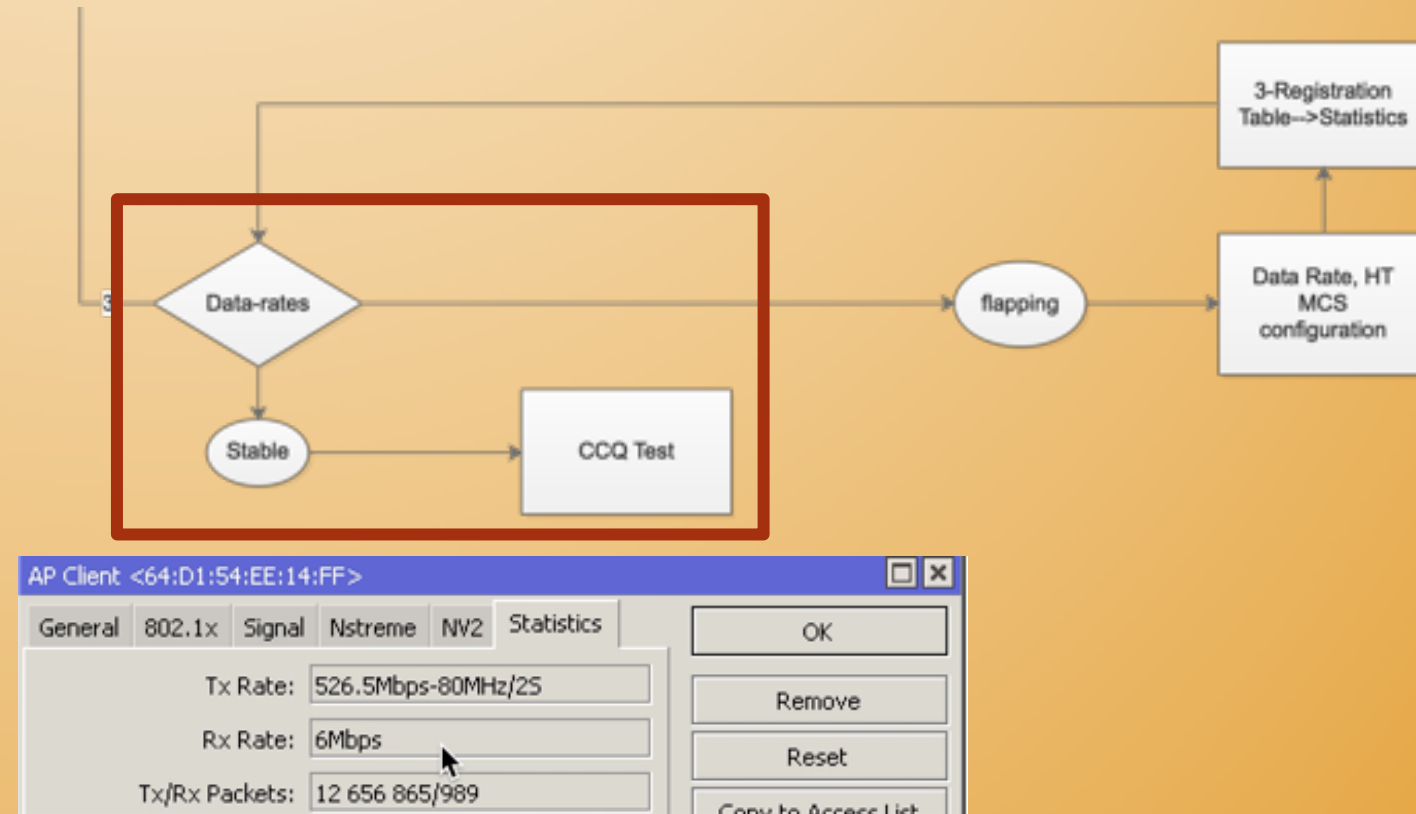
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Canada, 2019



# Registration Table, Signal

MUM  
Canada, 2019

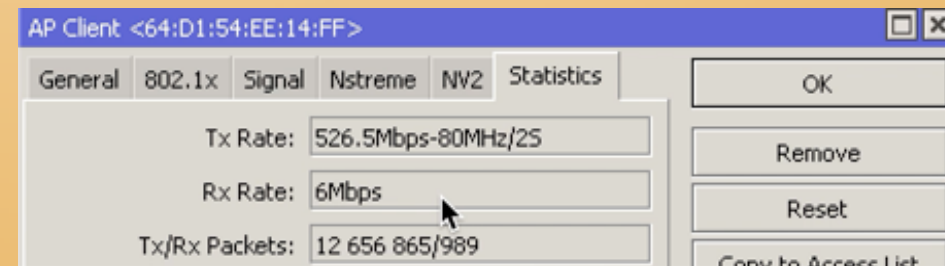
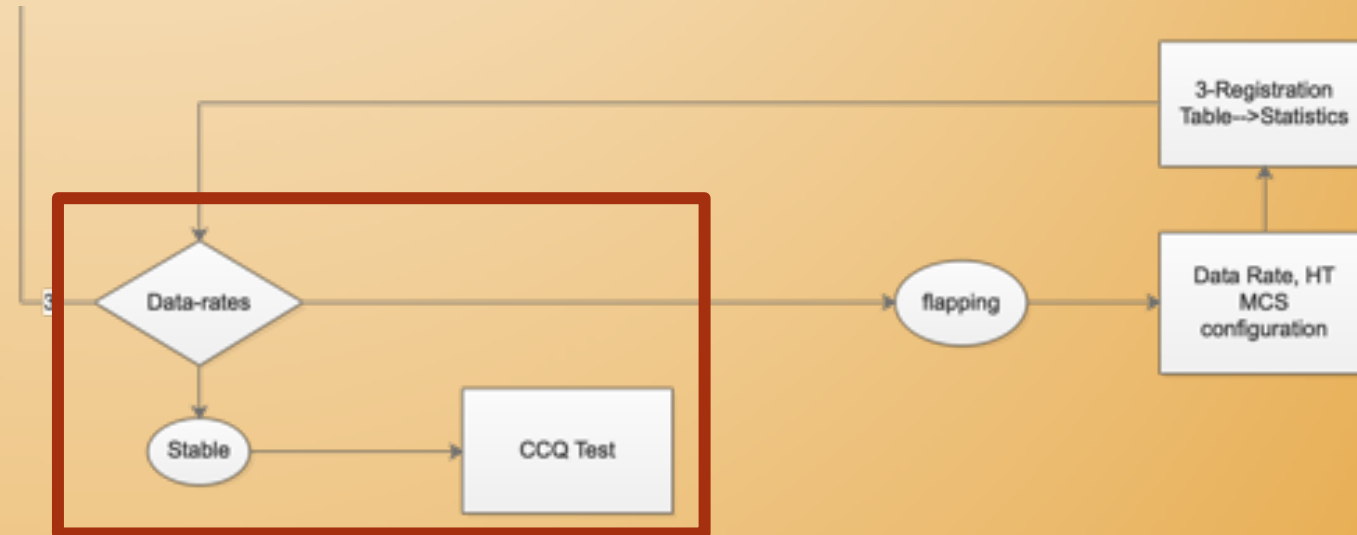
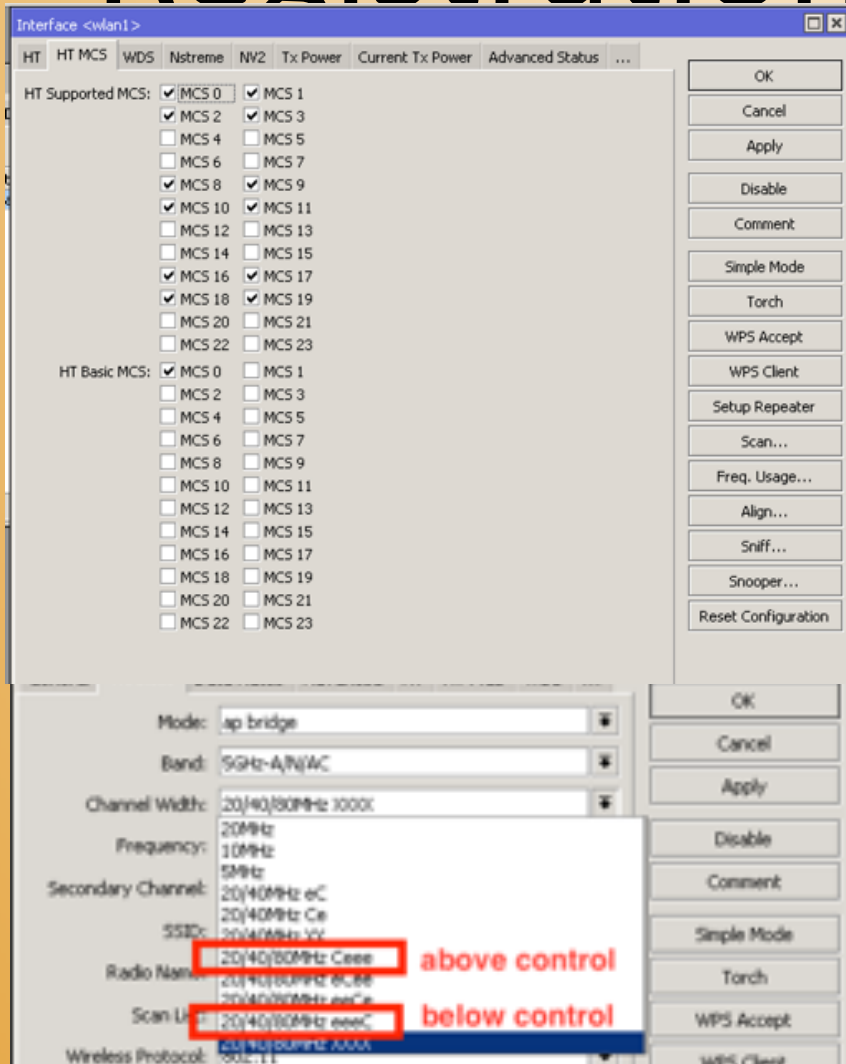
| Modulation and coding schemes |                 |                 |             |                                      |           |                |           |
|-------------------------------|-----------------|-----------------|-------------|--------------------------------------|-----------|----------------|-----------|
| MCS Index                     | Spatial streams | Modulation type | Coding rate | Data rate (in Mbit/s) <sup>[a]</sup> |           |                |           |
|                               |                 |                 |             | 20 MHz channel                       |           | 40 MHz channel |           |
|                               |                 |                 |             | 800 ns GI                            | 400 ns GI | 800 ns GI      | 400 ns GI |
| 0                             | 1               | BPSK            | 1/2         | 6.5                                  | 7.2       | 13.5           | 15        |
| 1                             | 1               | QPSK            | 1/2         | 13                                   | 14.4      | 27             | 30        |
| 2                             | 1               | QPSK            | 3/4         | 19.5                                 | 21.7      | 40.5           | 45        |
| 3                             | 1               | 16-QAM          | 1/2         | 26                                   | 28.9      | 54             | 60        |
| 4                             | 1               | 16-QAM          | 3/4         | 39                                   | 43.3      | 81             | 90        |
| 5                             | 1               | 64-QAM          | 2/3         | 52                                   | 57.8      | 108            | 120       |
| 6                             | 1               | 64-QAM          | 3/4         | 58.5                                 | 65        | 121.5          | 135       |
| 7                             | 1               | 64-QAM          | 5/6         | 65                                   | 72.2      | 135            | 150       |
| 8                             | 2               | BPSK            | 1/2         | 13                                   | 14.4      | 27             | 30        |
| 9                             | 2               | QPSK            | 1/2         | 26                                   | 28.9      | 54             | 60        |
| 10                            | 2               | QPSK            | 3/4         | 39                                   | 43.3      | 81             | 90        |
| 11                            | 2               | 16-QAM          | 1/2         | 52                                   | 57.8      | 108            | 120       |
| 12                            | 2               | 16-QAM          | 3/4         | 78                                   | 86.7      | 162            | 180       |
| 13                            | 2               | 64-QAM          | 2/3         | 104                                  | 115.6     | 216            | 240       |
| 14                            | 2               | 64-QAM          | 3/4         | 117                                  | 130       | 243            | 270       |
| 15                            | 2               | 64-QAM          | 5/6         | 130                                  | 144.4     | 270            | 300       |
| 16                            | 3               | BPSK            | 1/2         | 19.5                                 | 21.7      | 40.5           | 45        |
| 17                            | 3               | QPSK            | 1/2         | 39                                   | 43.3      | 81             | 90        |
| 18                            | 3               | QPSK            | 3/4         | 58.5                                 | 65        | 121.5          | 135       |
| 19                            | 3               | 16-QAM          | 1/2         | 78                                   | 86.7      | 162            | 180       |
| 20                            | 3               | 16-QAM          | 3/4         | 117                                  | 130       | 243            | 270       |
| 21                            | 3               | 64-QAM          | 2/3         | 156                                  | 173.3     | 324            | 360       |
| 22                            | 3               | 64-QAM          | 3/4         | 175.5                                | 195       | 364.5          | 405       |
| 23                            | 3               | 64-QAM          | 5/6         | 195                                  | 216.7     | 405            | 450       |

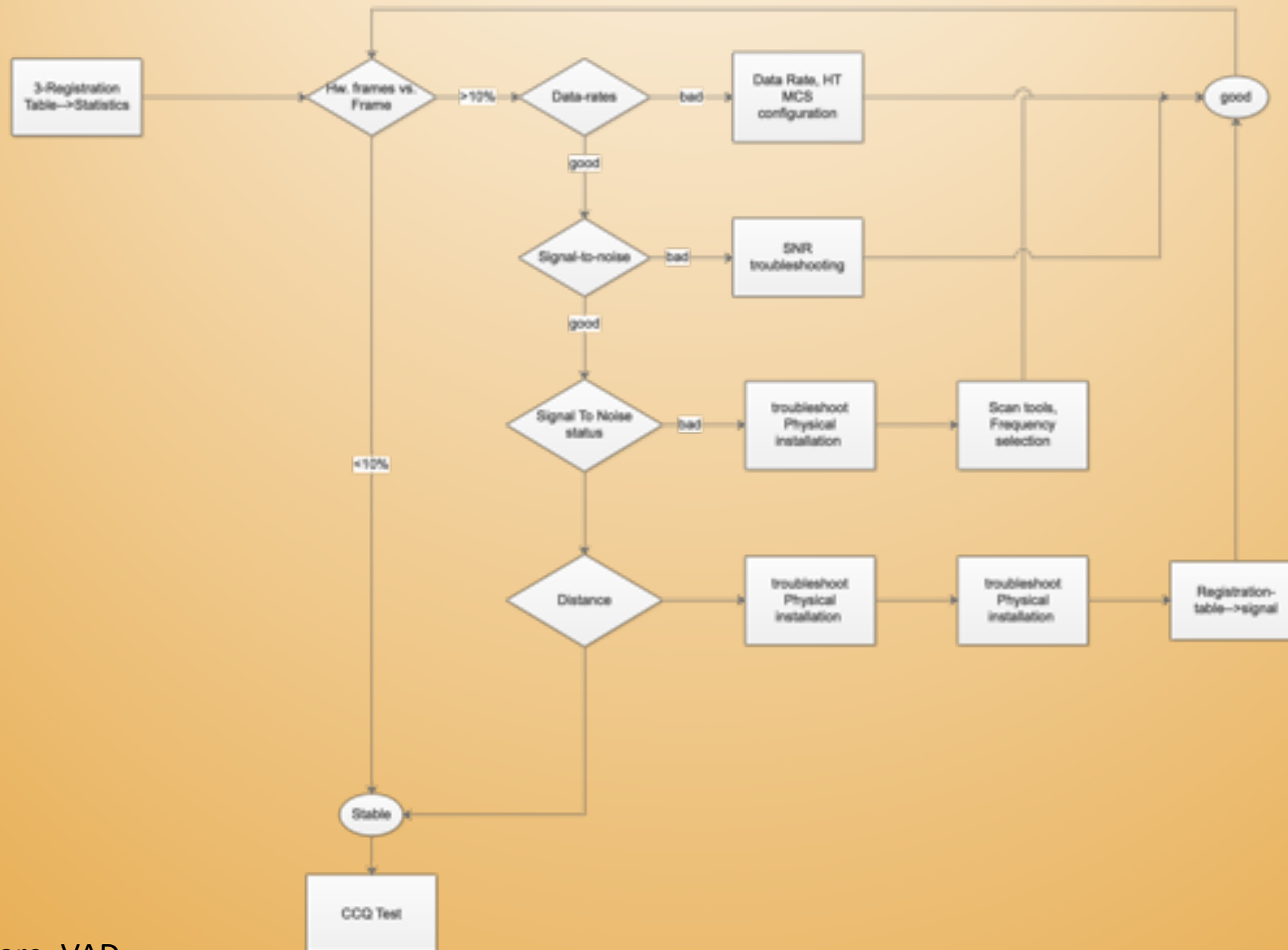




# Registration Table, Signal

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# Question?