60 GHz PTP and P2MP multipoint capabilities

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Wireless unlicensed band comparison

2.4 GHz 802.11b/g/n	5 GHz 802.11a/n/ac	60 GHz 802.11ad
- • Crowded spectrum • Low available channel count	- • DFS and radar detection • Rapidly increasing channel widths	- • Oxygen absorption • Low distance • Less channels
+ • Higher distances • Better penetration through objects	+ • High throughput • More available channels	+ • The highest throughput • Free spectrum

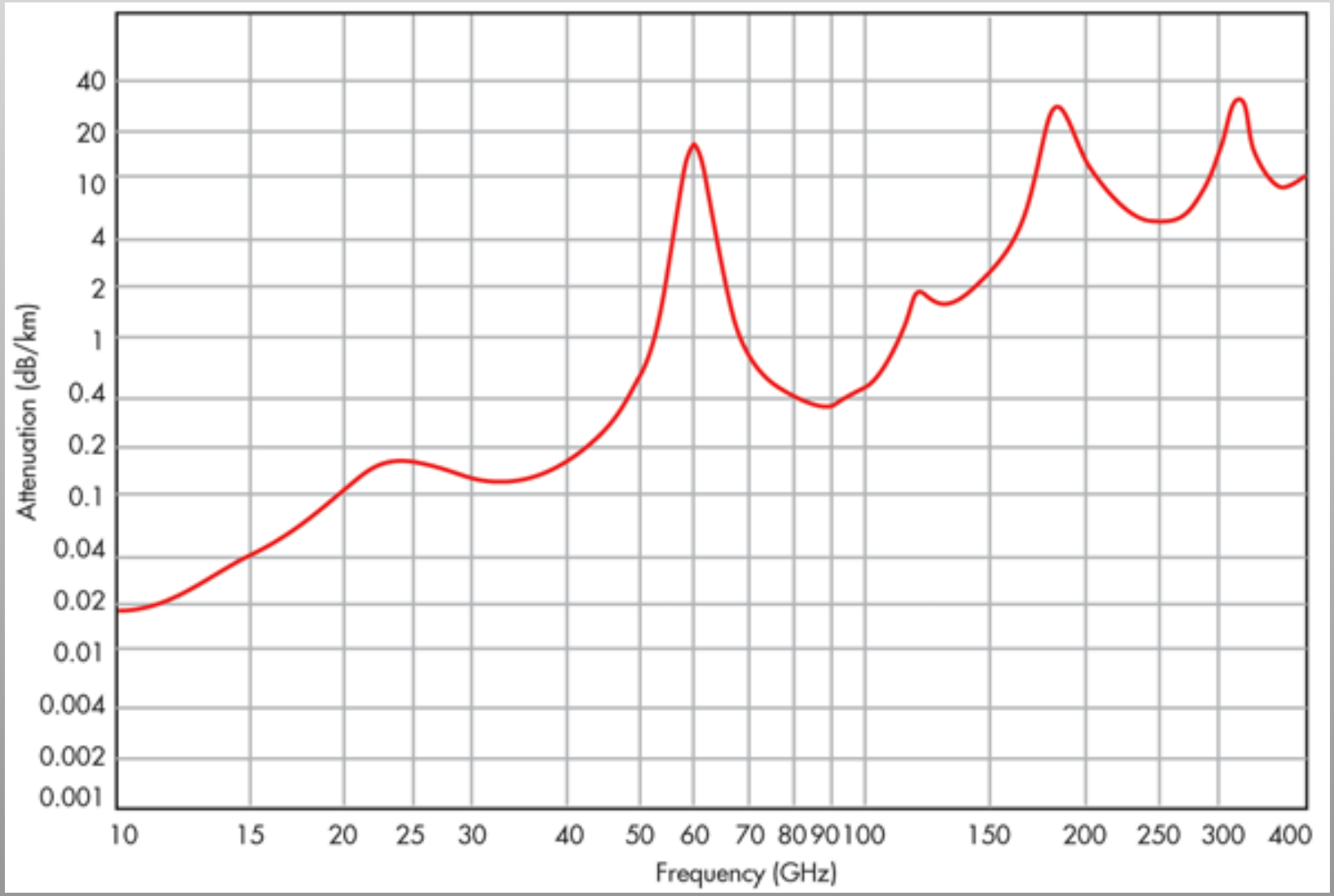


Image Source:
http://www.electronicdesign.com

Wireless Wire



Wireless Wire

- Pre-configured 60 GHz radio link (Plug and Play)
- 4 core CPU running at 716 MHz, 256 MB of RAM
- Only 5 W of maximum power consumption

  802.11af/at
- Range of 200 meters or more
- Beamforming and PtMP support

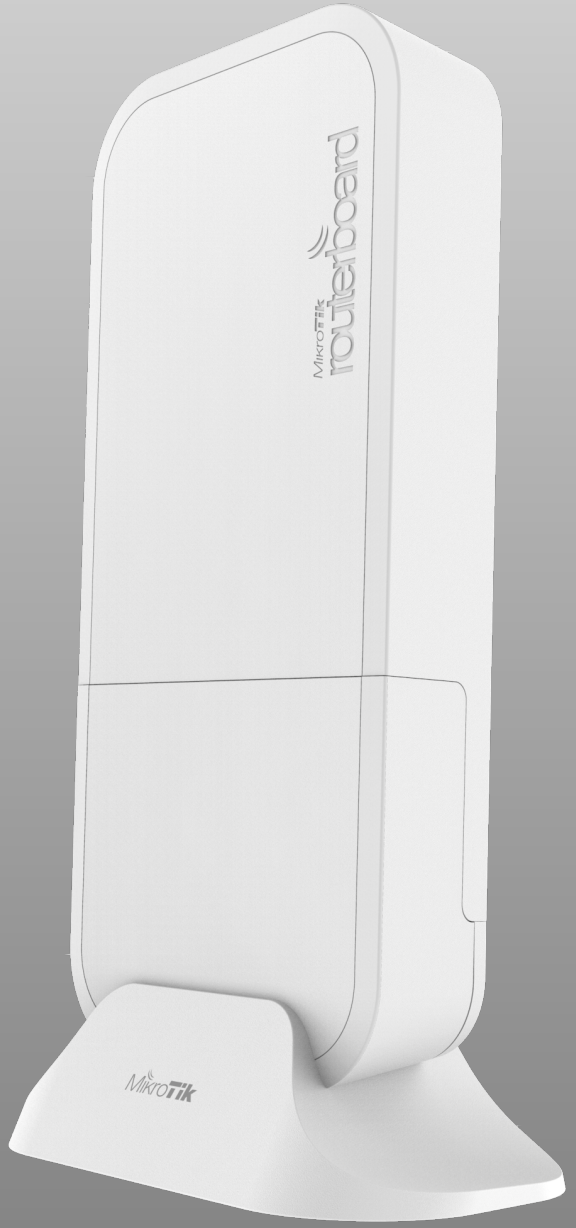
Wireless Wire

- Channel bandwidth 2.16 GHz
- Total EIRP under 40 dBm
- EN 302 567
- 32 antenna elements
- Sweeps between 64 antenna patterns
- Wireless coverage close to 180 degrees
- Price $198 for kit of two devices

wAP 60G and wAP 60G AP

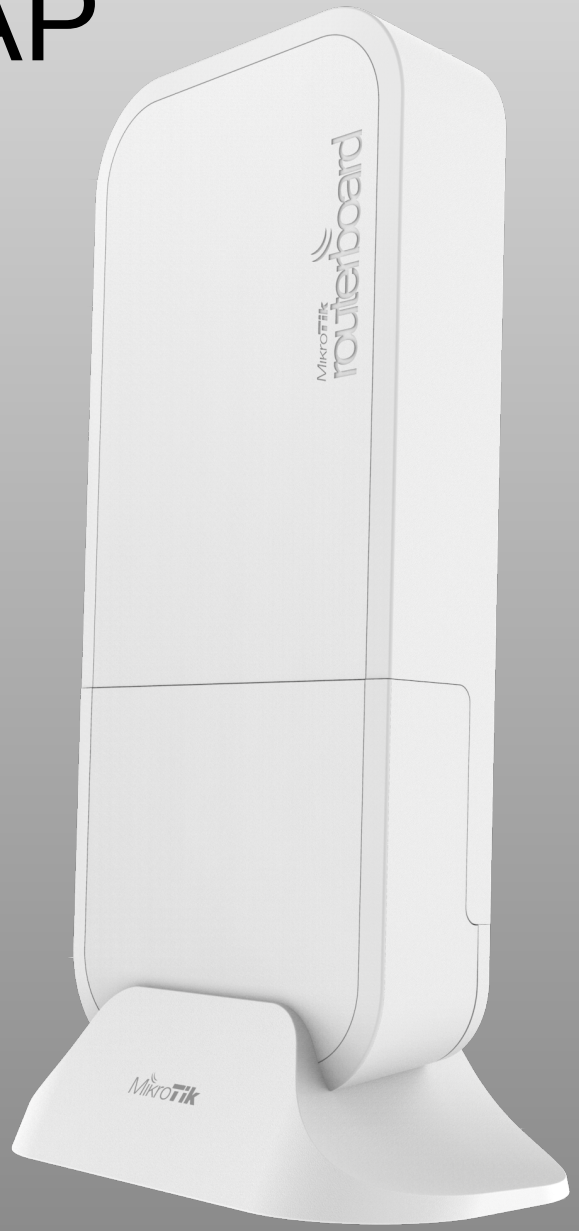
- Same hardware as used in Wireless Wire kit
- Total EIRP under 40 dBm
- EN 302 567
- License level 3
- Price $99 (Level3)

  129$ (Level4)



wAP 60Gx3 AP

- Multiple antenna elements provide wider field or view
- Access Point device for 8 clients
- 180 degree field of view
- Price $199 (Level4)



SXTsq Lite60

- For distances 200m+
- Slim design
- EN 305 550 and
  EN 302 567
- License level 3
- Fast Ethernet
- Price $69



LHG 60G kit

- For distances up to 1500 m+
- Antenna gain 42 dBi
- Total EIRP under 55dBm
- EN 302 217 – Fixed Point to Point compliant
- License level 3
- Price $298 for kit



LHG Lite60

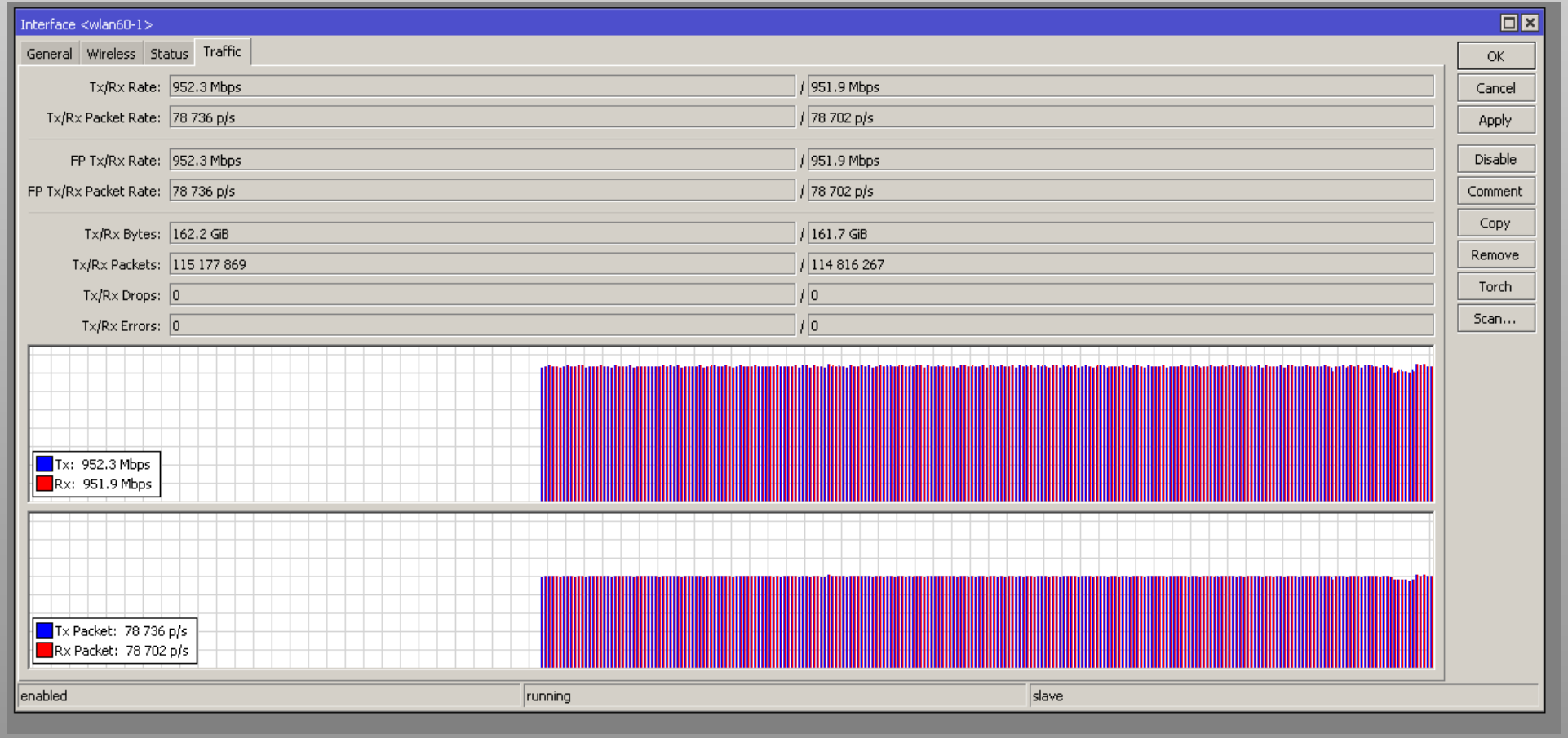
- Low cost unit
- Fast Ethernet
- Works in the same distances as LHG60G(1500m+)
- Designed as long range CPE in PtMP setups
- Price $99



Wireless modes

- Wireless modes for 60 GHz
  - “ap-bridge”
  - “bridge”
  - “station-bridge” (WDS equivalent)
  - “sniff”
- Configuration under “/interface w60g” menu
  - SSID
  - Password
  - Mode

Performance in 1500 meter link



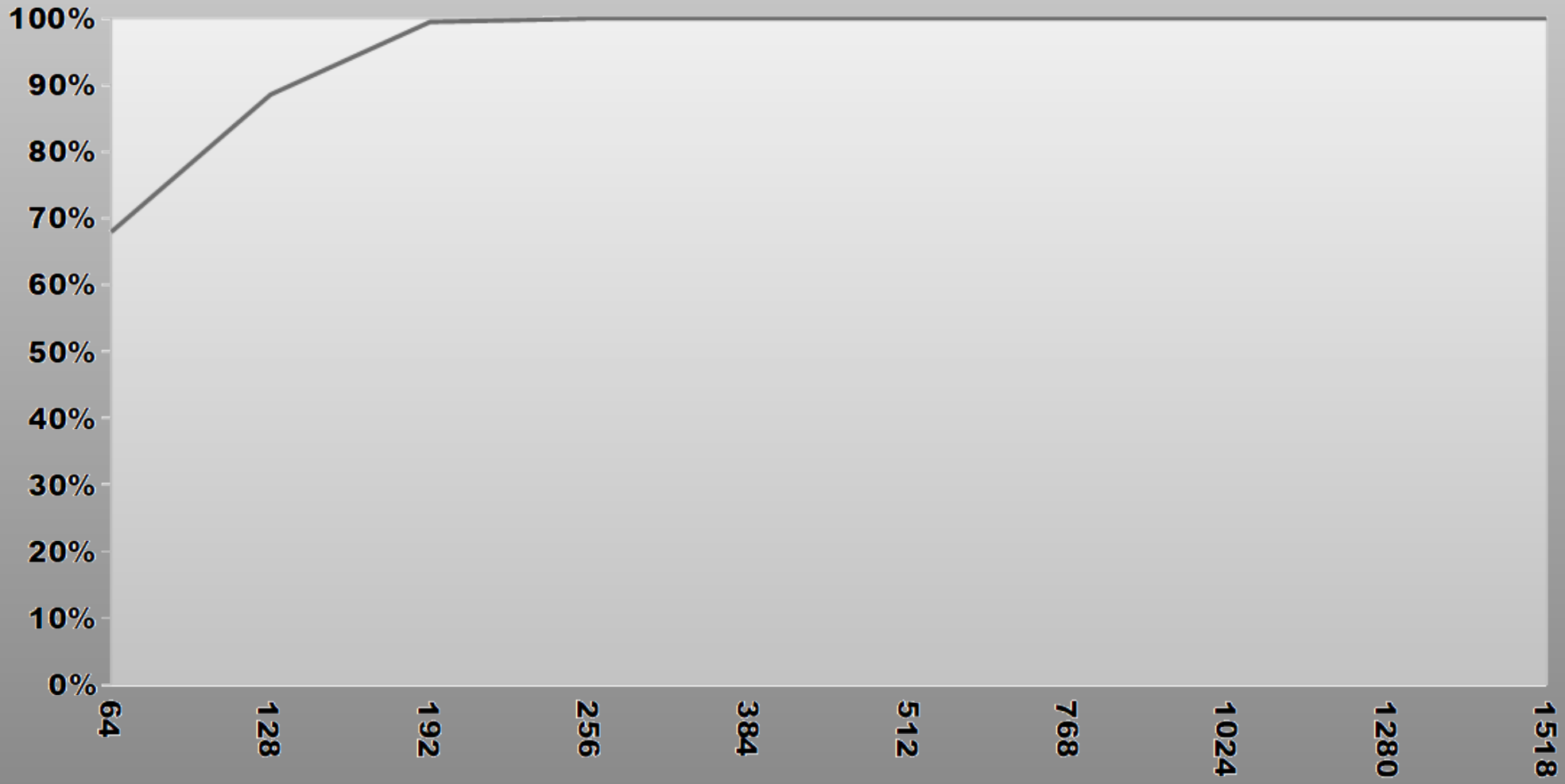
Winbox traffic graph showing “Wireless Wire Dish” speed on 1500 m link

Performance comparison to wired network

Throughput (<0,1% loss)	Theoretical max		16 Streams both ways			4096 Streams both ways		
Frame size (bytes)	kpps	Mbps	kpps	Mbps	%	kpps	Mbps	%
64	2976,1	1 523,8	2022	1 035,3	**67,94**	1977	1 012,2	**66,43**
128	1689,2	1 729,7	1496,2	1 532,1	**88,57**	1612	1 650,7	**95,43**
192	1179,2	1 811,3	1173	1 801,7	**99,47**	1173	1 801,7	**99,47**
256	905,8	1 855,1	905,8	1 855,1	**100,00**	905,8	1 855,1	**100,00**
384	618,8	1 901,0	618,8	1 901,0	**100,00**	618,8	1 901,0	**100,00**
512	469,9	1 924,7	469,9	1 924,7	**100,00**	469,9	1 924,7	**100,00**
768	317,2	1 948,9	317,2	1 948,9	**100,00**	317,2	1 948,9	**100,00**
1024	239,4	1 961,2	239,4	1 961,2	**100,00**	239,4	1 961,2	**100,00**
1280	192,3	1 969,2	192,3	1 969,2	**100,00**	192,3	1 969,2	**100,00**
1518	162,5	1 973,4	162,5	1 973,4	**100,00**	162,5	1 973,4	**100,00**
TCP connection	181,6	1 970,6	181,6	1 970,6	**100,00**	181,6	1 970,6	**100,00**

All UDP tests are done with Xena Networks specialized test equipment (XenaBay),and done according to RFC2544 (Xena2544) with 0,1% acceptable loss
TCP tests done by using iperf3:
https://iperf.fr/

Performance comparison to wired network



Point to Multi Point support

- Experimental support already available starting from 6.41
- Requires level 4 license for AP device
- Connected clients are treated as individual interfaces - easy to configure and manage
- Supports 8 simultaneously connected clients

wAP60G, SXTsq 60 and LHG60G

- All devices are mutually compatible
- wAP60G – makes excellent Access Point for PTMP usage case together with LHG 60G client devices
- Easy to deploy, easy to configure and monitor
- Fastest PTMP solution at this price range

wAP 60G or wAP60G x3 and LHG60G

Distance Meters*	RSSI wAP60G	RSSI LHG60G	Total Throughput
300	-63	-68	1.8Gbps
500	-63	-68	1.8Gbps
600	-65	-69	1.8Gbps
700	-66	-69	1.5Gbps
800	-66	-69	1.2Gbps
850	-68	-69	800Mbps
900	-70	-72	100Mbps

*Tests done before latest software changes increasing distance

W60G new features

- Re-calibrated antenna sectors increasing distance over 200m for wAP60G (RouterOS update required) and increasing Wireless Wire dish maximum distance
- Added RSSI for monitoring signal strength
- Added distance measurement tool
- Updated Beamforming pattern information for easier LHG60G alignment

W60G new features

- More improvements in Beamforming efficiency
- Throughput improvements when link fully utilized
- Improved P2MP throughput performance
- Added 4th channel (Center frequency 64800MHz) and 66000MHz frequency(CLI only), supports distances up to 4Km
- Added new align feature in the RouterOS

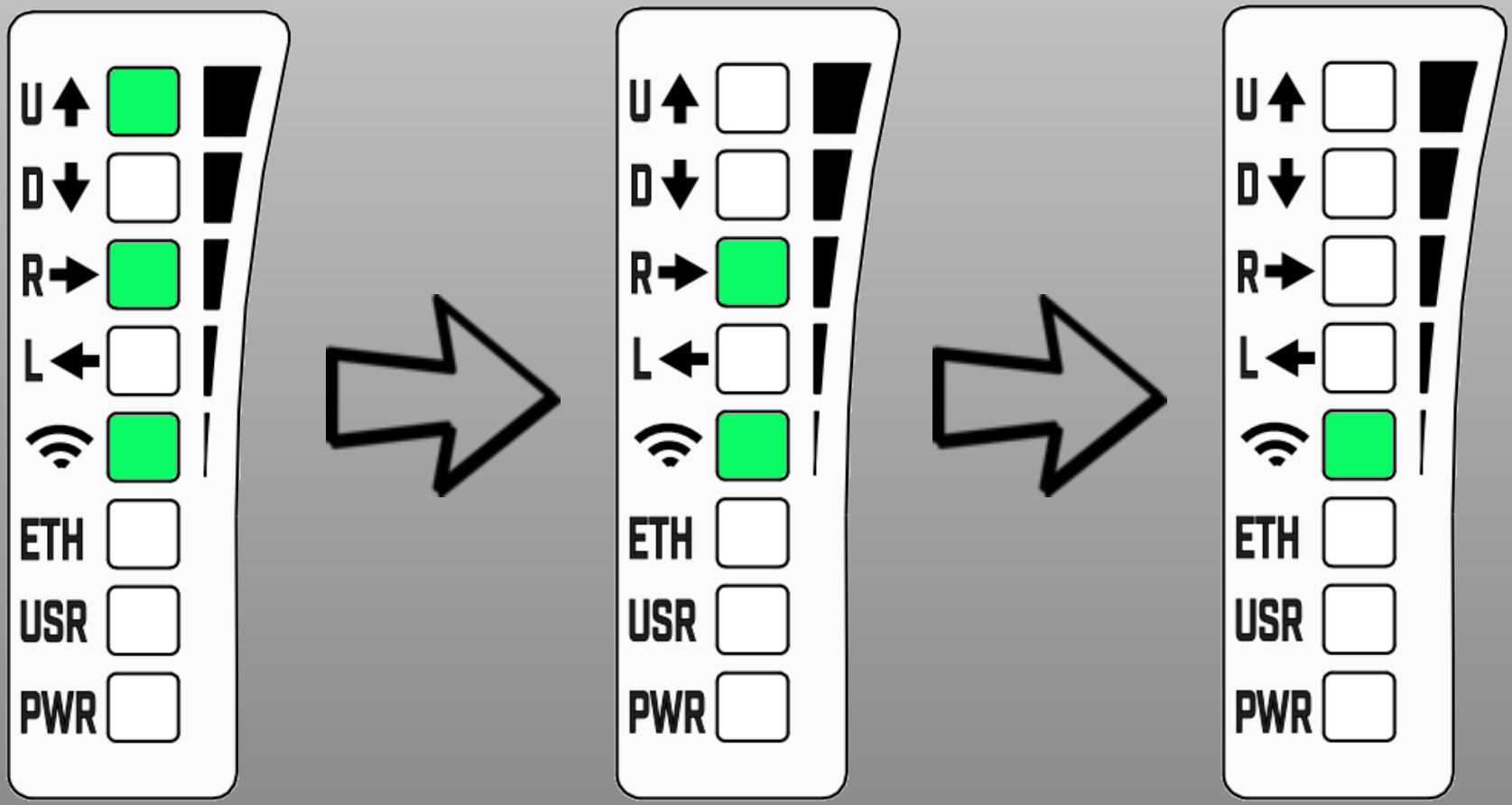
W60G new features

- Added new align feature in the RouterOS

```
[admin@AP_AB_BlackBox] > interface w60g align wlan60-1
             connected: yes
             frequency: 58320
        remote-address: 04:D6:AA:6E:CD:14
                 tx-mcs: 4
            tx-phy-rate: 1155.0Mbps
                signal: 60
                  rssi: -63
             tx-sector: 58
        tx-sector-info: right 11.4 degrees, up 26.6 degrees
              distance: 0.88m
  tx-packet-error-rate: 0%
-- [Q quit|D dump|C-z pause]
```

W60G new features

- LEDs help to find best Beamforming pattern

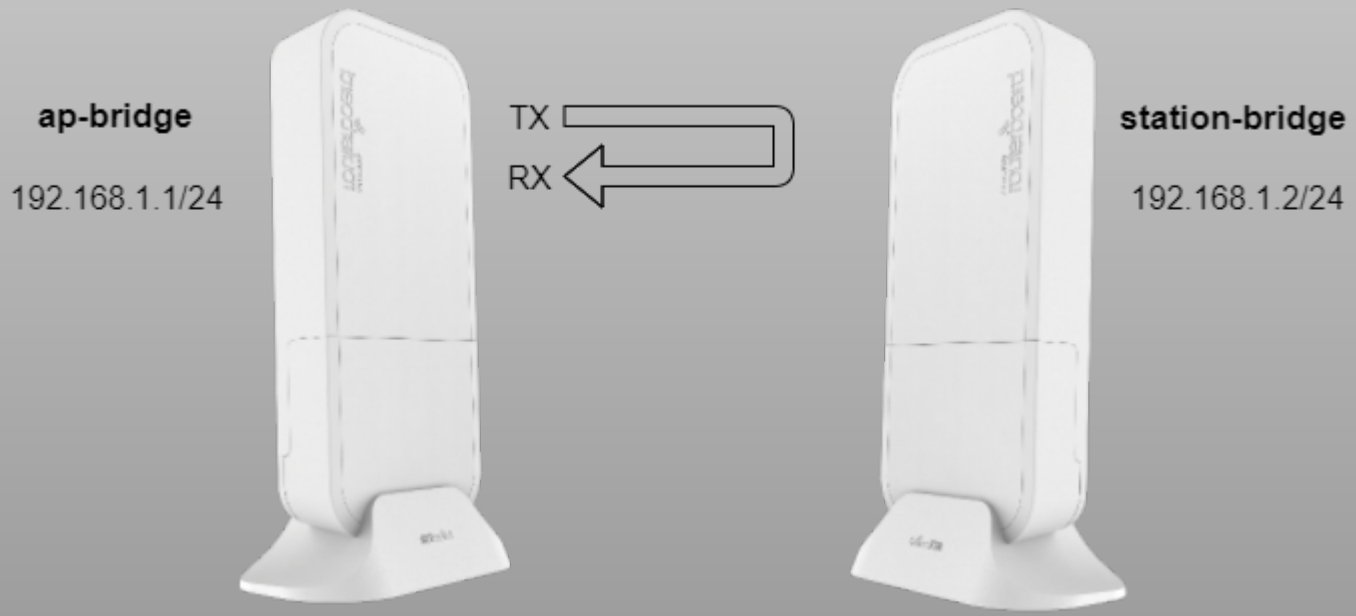


Testing software

- Bandwidth test
  - Works under RouterOS, PC (Windows, Mac, Linux)
- Traffic Generator
  - Works under RouterOS
- Iperf and iperf3
  - Works on PC (Windows, Mac, Linux)
- Speedtest.net
- Other tools

Live demo

Test setup:




```
/tool traffic-generator packet-template
add ip-dst=192.168.1.1 ip-gateway=192.168.1.2 ip-src=192.168.1.10 name=test1 udp-dst-port=100-300
/tool traffic-generator stream
add mbps=900 name=stream1 packet-size=1500 tx-template=test1
```

Live demo

- To start Traffic Generator run:

  /tool traffic-generator start

- To stop:

  /tool traffic-generator stop

- To run temporary Traffic Generator with extra arguments:

  /tool traffic-generator quick mbps=300 packet-size=256 duration=100

Thank you for your attention!