

## Wi-Fi Services & Speed User Guide

This user guide will assist in understanding local Wi-Fi networks and how the performance of the Wi-Fi network determines your final user browsing experience. It will also help to identify constraints in a typical Wi-Fi network.

### How do I do a speed test?

To test your Twoobii internet link speed you can follow the steps below:

- Go to <http://speedtest.twoobii.com/>. It is best to run the speed test with your PC connected directly to the Twoobii iDirect modem **via a network cable** and all other devices disconnected from the modem. If you do the test using a Wi-Fi connection the results will be affected by the Wi-Fi connection and could be misleading.
- Other speed-testing software or websites do not provide a true recognition of the Twoobii network's performance.
- Remember to Close ALL applications using data before running Speed test, this includes Dropbox, Google Drive, synchronisation for update purposes, and others.

### Interpreting Speed test results.

**Download:** This indicated your download or receiving data speed in Mbps, a typical reading should be between 70% and 90% of the maximum data speed of your service profile.

**Upload:** This indicates the upload speed or transmitting data speed in Mbps, a typical reading should be between 70% and 90% of your service profile speed.

**Latency:** This defines the IP packet round trip latency from your device to Internet router and back, the theoretical minimum for satellite networks is 550msec with the typical average being 650msec.

### What influence Wi-Fi experience?

All Wi-Fi in South Africa, as elsewhere in the world, operates in

shared frequency bands. Both the 2.4 GHz and 5 GHz bands are unregulated, meaning it is free to use, it also means there are a lot of users of these bands. Being IP data traffic, the more interference there is, the more data packet errors and the lower the effective data speed. Wi-Fi networks are also build using multiple access points that are installed through the user environment, i.e. home or office etc. The more access points are installed the better quality of Wi-Fi signal will be experienced. Thus, the key elements that determine the user's Wi-Fi experience are **signal level** and **data interference**.



## Does Wi-Fi cover my house?

**No**, A single Wi-Fi access point can't cover your house. Where you can use your Wi-Fi service in your house are determined by 1) Range 2) Obstructions 3) Signal frequency and 4) Your user device.

### Range and Obstructions

There are essentially two factors that affect signal attenuation between the access point and the user's laptop, those are **range** (or distance) and attenuation due to **obstructions**. To have Wi-Fi service in your entire residence you will have to install many Wi-Fi access points to ensure that you are always within the range limits and not exceeding the obstructions losses

This diagram shows a typical single storey home, with indicators showing what strength of Wi-Fi signal can be expected.



### Signal Frequency

Wi-Fi systems use 2.4GHz or 5GHz operating frequencies with new devices being able to select between both. There are some general differences between the two frequency bands.

- 5GHz has a shorter range than 2.4GHz;
- 2.4GHz is way more crowded than 5GHz leading to much more interference.
- 2.4 GHz has fewer channel options with only three of them non-overlapping, while 5GHz has 23 non-overlapping channels, making it less susceptible to interference.
- Fewer client devices are capable of using the 5GHz channel than the 2.4GHz channel.
- If there is too much interference around and your client devices support 5GHz, it's recommended to use 5GHz wireless network, else it's better to select 2.4GHz.
- A lot of other devices also use the 2.4 GHz frequencies, the biggest offenders are microwaves and cordless phones. These devices add noise to the Wi-Fi that can further reduce the speed of 2.4GHz wireless networks.

*Wi-Fi attenuation through typical building materials*

<b>Building Material</b>	<b>2.4GHz</b>	<b>5 GHz</b>
<i>Free Space Range</i>		
<i>Solid Wooden Door</i>		
<i>Hollow Wooden Door</i>		
<i>Steel/Fire Exit Door</i>		
<i>Concrete Wall (double brick)</i>		
<i>Concrete Wall (single brick)</i>		
<i>Reinforced Slab in double storey</i>		
<i>Single Pane Window</i>		

## Client devices

Due to size and cost limitations client devices, i.e. laptops, smartphones, etc generally have less sophisticated Wi-Fi capabilities than the fixed Wi-Fi access point. While an access point such as the Mikrotik may have multiple antennas, MIMO technology, and the ability to support both frequency bands (resulting in a high available throughput rate), client devices are often limited to a single antenna and the 2.4 GHz frequency band.

Wi-Fi throughput rates are determined by the least-capable device in the link, which is usually the client. Because of their compact construction and usually single antenna, client devices such as smartphones and tablets can be more sensitive to device orientation and may suffer slow throughput because of poor reception. This is inherent in the design of these devices and needs to be accommodated by the user by staying within a reasonable range of the access point.

More capable Wi-Fi clients such as laptop computers often have multiple antennas, MIMO technology, and dual band radios. These clients are specifically designed to operate effectively over a wireless network, and will be able to take best advantage of the data throughput provided by the access point. The ideal WLAN client will have 2 or more antennas, support 802.11ac, use MIMO technology, and be able to operate in the 5 GHz band for best performance.

## What about external interference?

The following tables show interference source that may contribute to reduced Wi-Fi performance.

2.4 GHz Interferers		
<b>VERY HIGH INTERFERERS</b>		
Microwave Oven	2.4 GHz Cordless Phone	Neighbours Wireless Devices
<b>OTHER INTERFERERS</b>		
Proximity Sensors	Wireless Mouse	Set-top Boxes
Wireless Audio Devices (headsets or speakers)	Bluetooth Device	Wireless Video/Surveillance Camera
Outdoor microwave links	Fluorescent Lights	WiMAX
Loose electrical connections	RF leakage (Satellite TV)	Baby Monitors
5 GHz Interferers		
<b>VERY HIGH INTERFERERS</b>		
5 GHz Cordless Phone	Nearby 802.11a or 802.11n WLANs	Radar (Weather or Military),
<b>OTHER INTERFERERS</b>		
Digital Satellite Transmissions	Outdoor wireless 5 GHz bridges	Perimeter sensors

## How can I improve the Wi-Fi coverage in my residence?

Wi-Fi coverage can be improved by moving the Wi-Fi access point to a better location, or by adding more Wi-Fi access points in the correct locations.

## How many users can I connect on my home network's access point?

Wi-Fi networks can connect a large number of devices, the real question is really how many users can concurrently use the Internet service and still have satisfactory service. Because the single Internet connection to your home or office are shared between all active devices, thus the more devices that are connected, the slower the user experience will become.

Due to the very different Internet user patterns and user behaviours no precise calculation or design rules can be applied. To calculate the overall Internet service required for your office or home the following guidelines can be used.

Application	Users active at the same time	Per user	Total
Cisco VoIP G.729	3	16 kbps	48 kbps
Spotify Audio Mobile Quality	2	96 kbps	192 kbps
WebEx Voice Only Conference Call	1	120 kbps	120 kbps
Web Browsing & Email (Light)	1	250 kbps	250 kbps
Web Browsing & Email (Moderate)	1	500 kbps	500 kbps
Skype Standard Definition Video Call	4	600 kbps	2400 kbps
Web Browsing & Email (Heavy)	1	1 Mbps	1 Mbps
YouTube 480p Video Streaming	2	1 Mbps	2 Mbps
Netflix Low Quality Video	1	1.5 Mbps	2 Mbps
YouTube HD 720p Video Streaming	1	2.5 Mbps	3 Mbps
File Sharing (Typical)	0	5 Mbps	0 Mbps
<b>Total</b>	<b>17</b>		<b>10 Mbps</b>

