

Common MikroTik WiFi mistakes and how to avoid them

or - When Mike installed MikroTik WiFi!

- 1970's Trained to be a Naval Radio and Electronics Officer and learnt a lot of theory about RF and Marine Electronics
- 1980's Entered into UK Government Service and learnt a lot about the **practical** application of RF
- Next 30+ years 'playing' with RF from 10kHz to 100GHz

- 1997 - 1999 Saw the birth of point to point bridging by the likes of Breezom (now Alvarion)
- Early 2000's started to be more involved with modified WiFi APs being used illegally by WISPs as uWave links and troubleshooting interference problems mainly on ... 2.4GHz
- 20 years later, still troubleshooting WiFi problems on... 2.4GHz 🤪 (but mainly now with MikroTik)

Ron Touw

- MikroTik Consultant in 2008
- MikroTik Trainer #57 in 2009
- Head of Technical Training at LinITX (Largest UK MikroTik 'Master Distributor' and a 'Value Added Distributor')
- Seven employees with various MikroTik Certifications

LinITX - UK #1 on Mikrotik website based on sales



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LinITX - More than a 'box shifter'

- Not just a Value Added Master Distributor ...
- Also a Certified MikroTik Training Centre
- Dedicated Training Room
- Two certified MikroTik Trainers

LinITX - More than a 'box shifter'

- Not just a Value Added Master Distributor ...
- Also a founding member of the week-long MikroTik Training Bootcamp at MikroTik's own in-house RouterOS Training Centre in Riga
- Nearby 4* hotel (~€48/night B&B) flights from 78 cities around Europe including Aberdeen, Glasgow, Leeds, Doncaster, Gatwick, Stansted, Luton, East Midlands, Manchester and Dublin (from £74 return)

Our 'little' tour of Riga!



A photograph of a modern building with a yellow and blue facade, identified as the University Technical College Norfolk. The building has large windows and a brick base. The text is overlaid on the image.

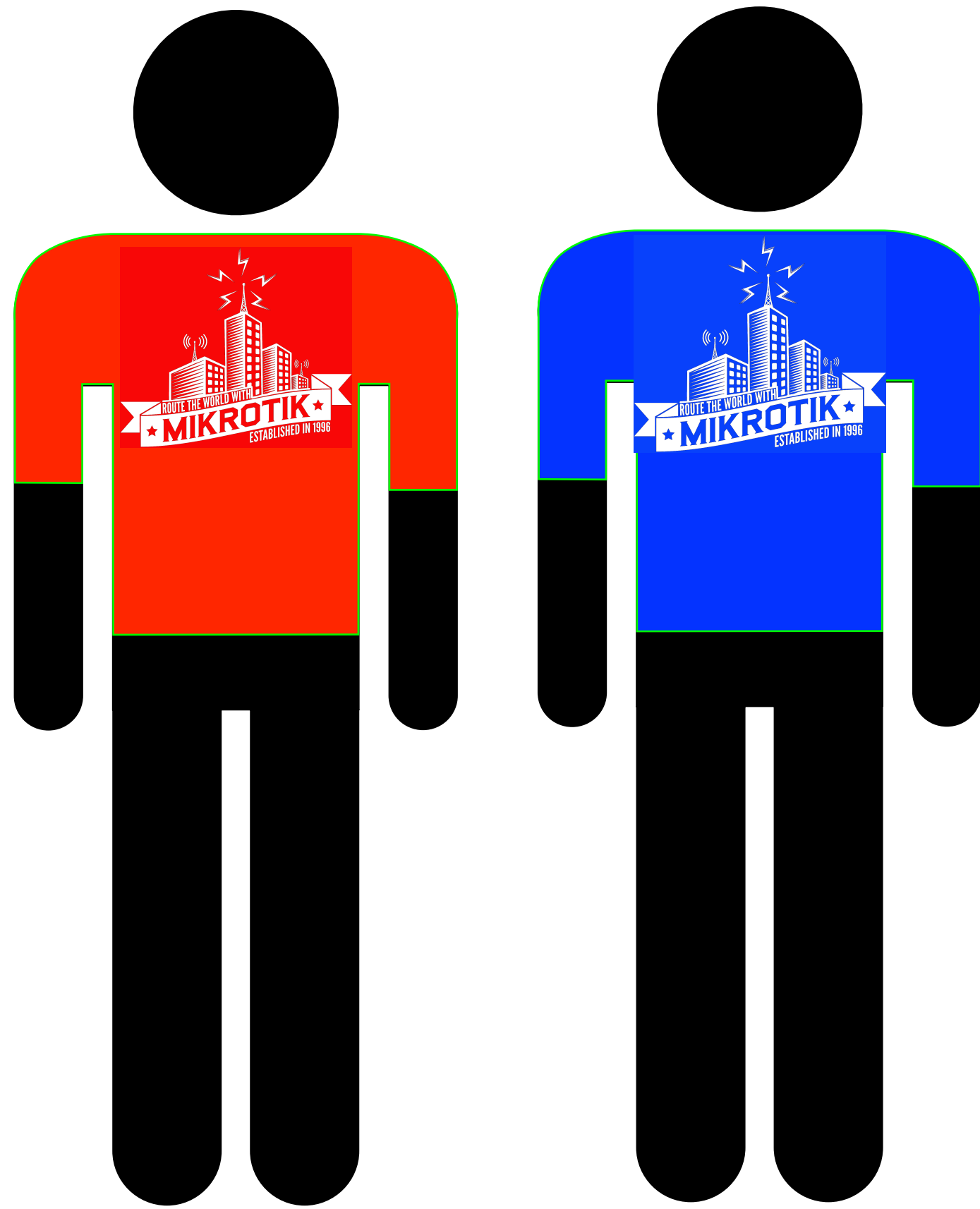
LinITX - More than a 'box shifter'

- Not just a Value Added Master Distributor ...
- We are also proud sponsors of the University Technical College in Norwich shortly becoming the UK's **First** MikroTik Academy
- Teaching students aged 14-18 basic networking skills with RouterOS and RouterBoards

Common MikroTik WiFi mistakes and how to avoid them

- This presentation is going to be based on real genuine mistakes our customers have made. Some of you will instantly see the problem, but really, we deal with this every day!
- I therefore hope you will never make these mistakes yourselves

Meet the MikroTik Fanboys!



Dave

Mike

- The last time we met Mike we learnt that he likes an all-in-one solution and Dave recommended to him the MikroTik hAP ac²
- He managed to finally sort out all the slow networking problems especially after watching a presentation of some cool guy from MikroTik at the Berlin MUM

Mike



- As a result of attending the MUM earlier this year, Mike even recently took his MTCNA at our Training Centre 😊
- Mike's even got a free MikroTik T- Shirt!

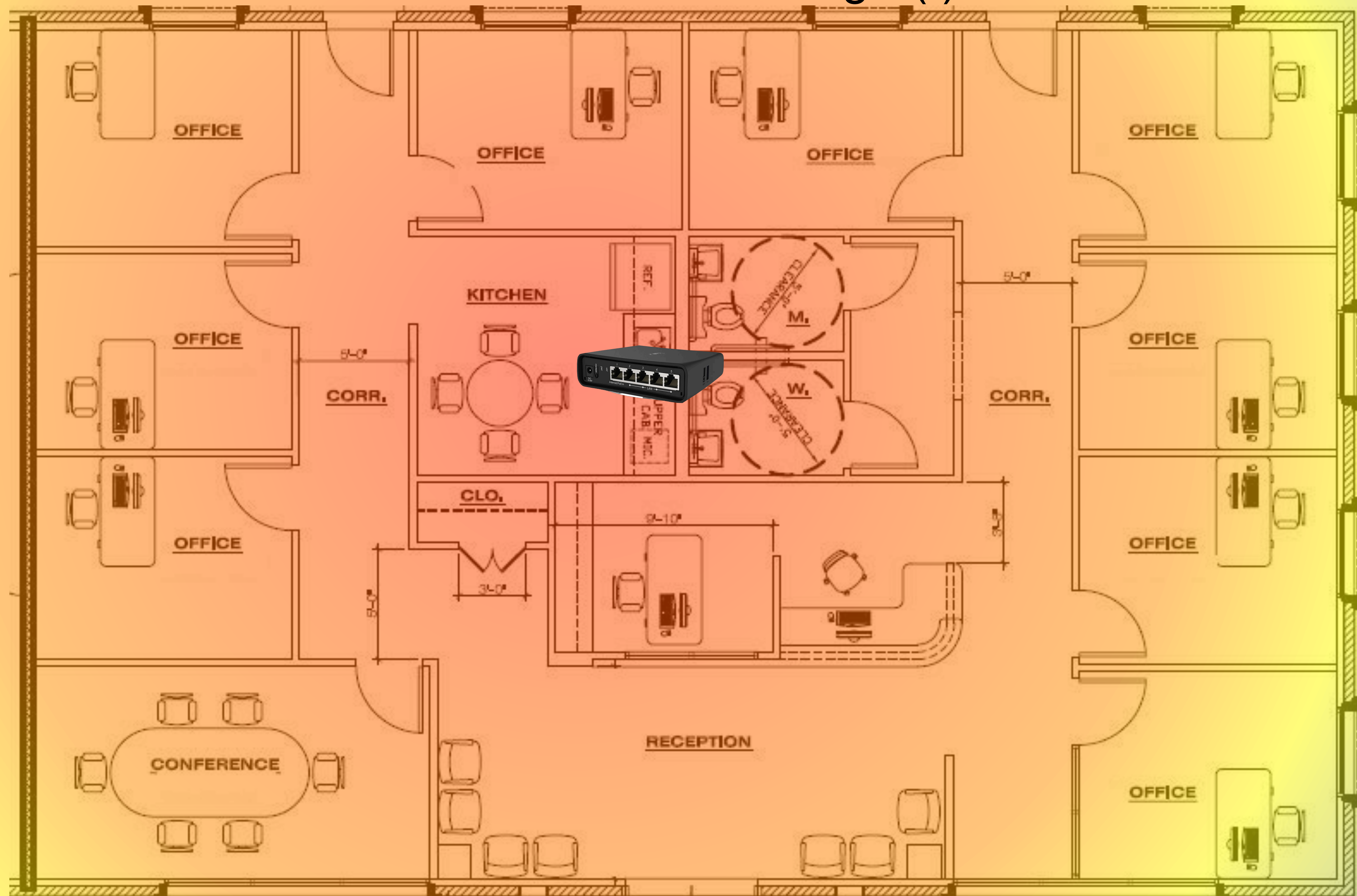
Marketing materials vs. reality

- Unlike the small Cisco router the hAP ac^2 replaced, the MikroTik RouterBoard also has built in “WiFi 5” on both 2.4GHz and 5GHz
- Mike plans on replacing his old tired 802.11b/g wireless solution for the wireless on the MikroTik.
- How far will it work? What will be it's coverage?
- Mike does some Googling...

Marketing materials vs. reality

- He couldn't find a documented 'range' of a MikroTik AP, but found a similar priced competitor that quoted 183m (600ft)
- Mike decides all he has to do is enable the built-in wifi in the hAP ac² he has.
- Mike dreams about his wifi coverage...

One AP - “183m Range”(!)



MikroTik 'does wireless'

- As the data cabinet is roughly in the centre of the office space, Mike thinks it's already in a good place
- (yes - the steel data cabinet ...)
- (In the canteen ...)
- (Just above the microwave ...)

Pride before the fall?

Mike was so proud of how simple it was to configure, he shared his excitement on social media as an inspiration to others to buy more MikroTik!



Mike the MikroTik Geek

@IT-Geek-Mike



Following

Loving these [@MikroTik_Com](#) hAP ac^2's dual band wireless APs. Had them setup and running in two minutes!



2:48 PM - 7 Oct 2018

MikroTik

UK MUM 2018

Lin **ITX**

Wireless is easy!

- He then walks around the office with his phone and gets 2-3 bars except in the far corners where he gets 1-2. Mike thinks that's not a good enough signal strength but can't think why.
- Maybe MikroTik wireless routers are not as good as the competition as they were quoting 183m range!

MikroTik 'does wireless'

- Mike phones Dave who points out the error of his assumptions

Mike's Mistakes

- What did Mike do wrong?
 - Believed sales / marketing material 😊 (i.e. Mike not understanding about absorption losses)
 - Metal data cabinet = “Faraday Cage”
 - 1 KW Microwave Oven on 2.4GHz !
 - 5GHz will also be very weak due to shielding

Mike's Mistakes

- Received signal strength is not a good indicator!
- Since Apple's 'AntennaGate' the signal strength bars response time has been slowed down therefore moving and measuring by signal bars is not going to react fast enough
- Google's latest Android 'Pie' has severely reduced the sampling speed for 'wireless scanning' apps!

Wireless surveys

- Mike Googles and finds that some online websites recommend changing the channel due to interference from other people's routers
- Mike wonders why he never thought of that!
- He reads that there are 13 channels on 2.4GHz and around 19 on 5GHz in Europe
- He plans to test all of those channels

Wireless Channels

- When he looks at the MikroTik frequency scan list, he notices that despite him being pretty sure there should be 13 channels on 2.4GHz and around 19 on 5GHz, he can only select from 'auto' or one of only 7 channels on each band!
- “7”? - Mike wonders why MikroTik do not support **all** 13 EU channels - maybe he's found a bug!

Wireless Channels

- He chooses each of the 7 channels in turn and measures the signal strength on his phone while running tests to speedtest.net.
- Mike finds that no matter which channel he chooses, they are all roughly the same signal strength and always give poor throughput unless he's standing in the Canteen.

Mike's "cool simple MikroTik config"

- 2.4GHz config...

```
/interface wireless set  
[ find default-name=wlan1 ]  
band=2ghz-b/g/n channel-width=20/40mhz-Ce  
frequency=auto mode=ap-bridge ssid=Office
```

Mike's "cool simple MikroTik config"

- and 5GHz config...

```
/interface wireless set  
[ find default-name=wlan2 ]  
band=5ghz-a/n/ac  
channel-width=20/40/80mhz-Ceee  
frequency=auto mode=ap-bridge ssid=Office
```


Mike's Mistakes

- What did Mike do wrong now you've seen the default config?
 - Basically - he trusted the 'default' factory settings
 - MikroTik creates default factory settings by having to make assumptions
 - Those assumptions will be guaranteed to be wrong for **your** setup.

Mike's Mistakes

- MikroTik default config for 2.4GHz is to enable 40MHz and configure for US/FCC channels
- There are only 7 US channels with 40M bandwidth
- The scan list contains all channels, regardless if they overlap
- Transmitter runs at maximum power - poor EVM
- 802.11b enabled

Mike's Mistakes

- Even if using 20MHz, there are not 13 “usable” channels on 2.4GHz
- Only 3. (Some suggest 4)
- Therefore testing all 13 channels on 2.4GHz is a waste of his time
- Should only test Ch1, Ch6 and Ch11

Mike's Mistakes

- Needs to select 'Regulatory domain' and input correct country
- Did not input antenna gain (2?) to reduce Tx Power and improve EVM - which would have lead to higher MCS data rates / performance
- Did not remove 802.11b (by selecting '802.11g/n')

Mike installs more APs

- Mike read on the internet that one AP for the office is not enough as walls block RF and found a blog suggesting a “one per room” plan is best
- He buys 12 CAP ac’s (one per room) and tries to put each AP on different non-overlapping channels
- He’s even set it to the right country to try to get the hallowed “13 channels” on 2.4GHz

Mike installs the APs

- Oddly however, he sees he now only has 9 channels not the full 13!
- The signal is no stronger and on 5GHz there now appears to be black holes of near zero coverage in some parts of the office

Frequency:	auto
	2412
SSID:	2417
	2422
Radio Name:	2427
	2432
Scan List:	2437
	2442
ess Protocol:	2447
	2452
urity Profile:	auto

Mike's Mistakes

- Using 40M channels on 2.4GHz restricts the available channels from 13, to 9.
- Large number of clients don't support 40MHz at all
- APs and Clients that do, usually set a "40MHz Intolerant" bit in Management Frames if they hear 20MHz traffic and drop down to 20MHz anyway!
- Only use Channels 1/6/11 (2412, 2437, 2462MHz)

Mike's gives up!

- Mike now has an AP in every room, each AP is only using 20M channel bandwidth and signal levels are “5 bars” everywhere in the office
- Mike has ensured that every AP is on a different channel wherever possible however..
- User throughput is poor and black holes of coverage persist

Dave's Advice for 2.4GHz...

- `/interface wireless`
`set [ find default-name=wlan1 ]`
`antenna-gain=2 band=2ghz-g/n channel-`
`width=20mhz country="united kingdom"`
`frequency-mode=regulatory-domain`
`mode=ap-bridge scan-list=2412,2437,2462`
`ssid=Office wireless-protocol=802.11`
`wmm-support=enabled wps-mode=disabled`

Dave's Advice for 5GHz...

- `/interface wireless`
`set [ find default-name=wlan2 ]`
`antenna-gain=2` `band=5ghz-a/n/ac`
`country="united kingdom"` **`frequency=auto`**
`frequency-mode=regulatory-domain`
`mode=ap-bridge ssid=Office`
`wireless-protocol=802.11`
`wmm-support=enabled wps-mode=disabled`

Mike Mistakes #3

- Not understanding that you can't use every 5GHz channel from the scan list due to lack of client support for DFS channels
 - In turn - leading to 'black holes' in WiFi coverage
- Always provide APs nearby on non-DFS channels

Mike finally understands?

- Dave recommends a MikroTik Consultant, someone who's helped him before and apparently knows a thing or two about wireless and MikroTik
- As a result of that consultation, Mike reconfigures everything again - hopefully for the last time!
- Also, he now seems to have a lot of spare APs

MikroTik Consultant's suggestions

- On 2.4GHz only use Ch1, 6 or 11
- Only use 20MHz channel widths
- Reduce the Transmit power by at least 7dB on 2.4GHz compared to that used on 5GHz
- Partly to discourage clients from using 2.4GHz

MikroTik Consultant's suggestions

- But, also, for the same distance away from an AP, and with the AP using the same identical Tx power on both bands and antenna gains, 2.4GHz signals are usually approximately 7dB stronger than 5GHz
- Therefore clients will usually go with the strongest signal and...
 - favour 2.4GHz! 😞

MikroTik Consultant's suggestions

- Therefore turn down the power on 2.4GHz by approx 7dB or even more to discourage 2.4GHz from being chosen
- Also, unless you have a specific client device that supports 802.11b only (very rare these days), turn 802.11b off

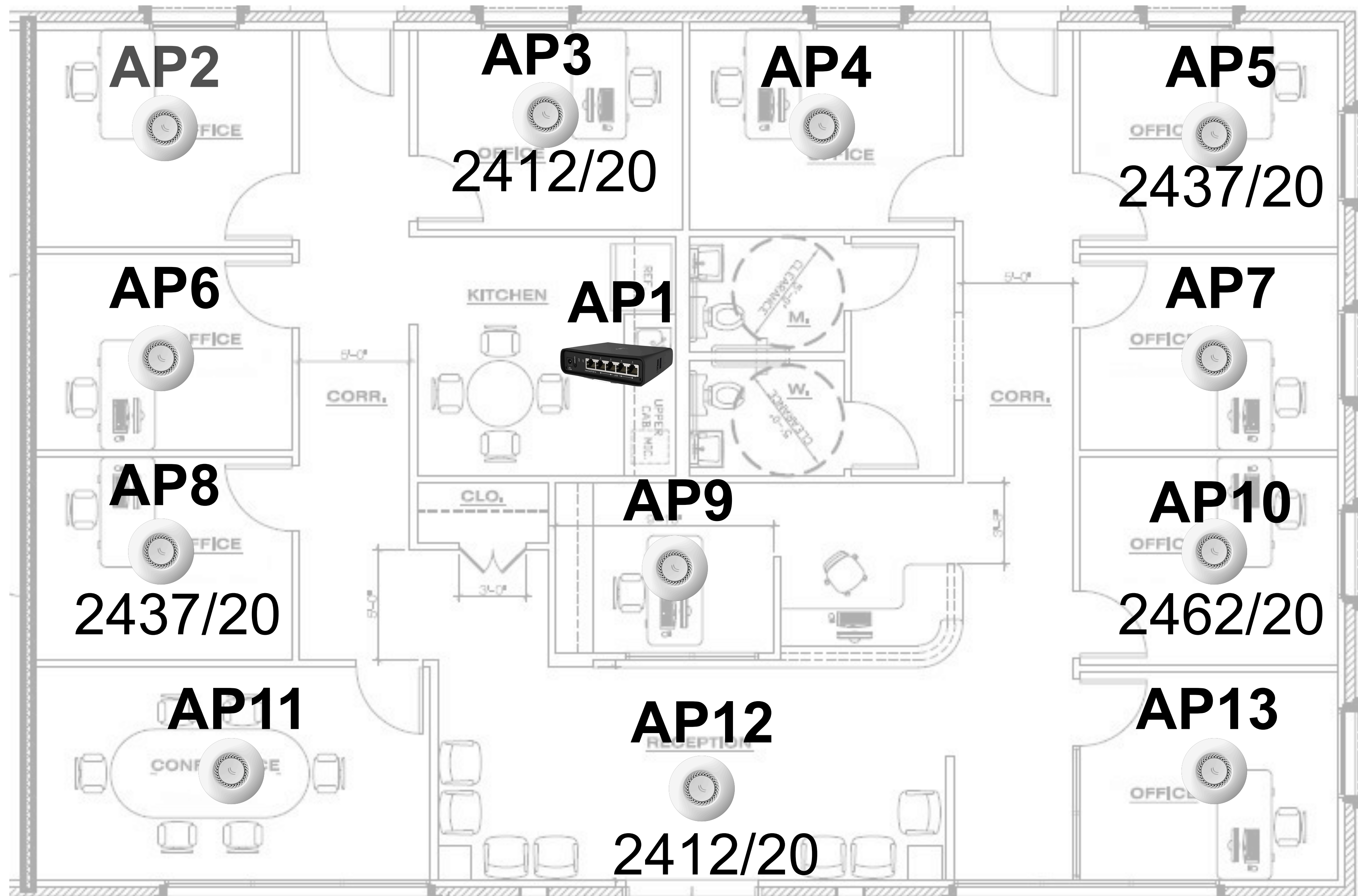
MikroTik Consultant's suggestions

- On 5GHz, try 40MHz first but be prepared to use 20MHz. Never use 80 or 160MHz except at home!
- Make sure to provide coverage from Ofcom Band A (U-NII-1) channels (indoors only!) as many clients do not support the DFS channels in Ofcom Bands A & B (U-NII-2A / 2C / 2e)
- Also because of the potential loss of an AP when a radar trigger event occurs

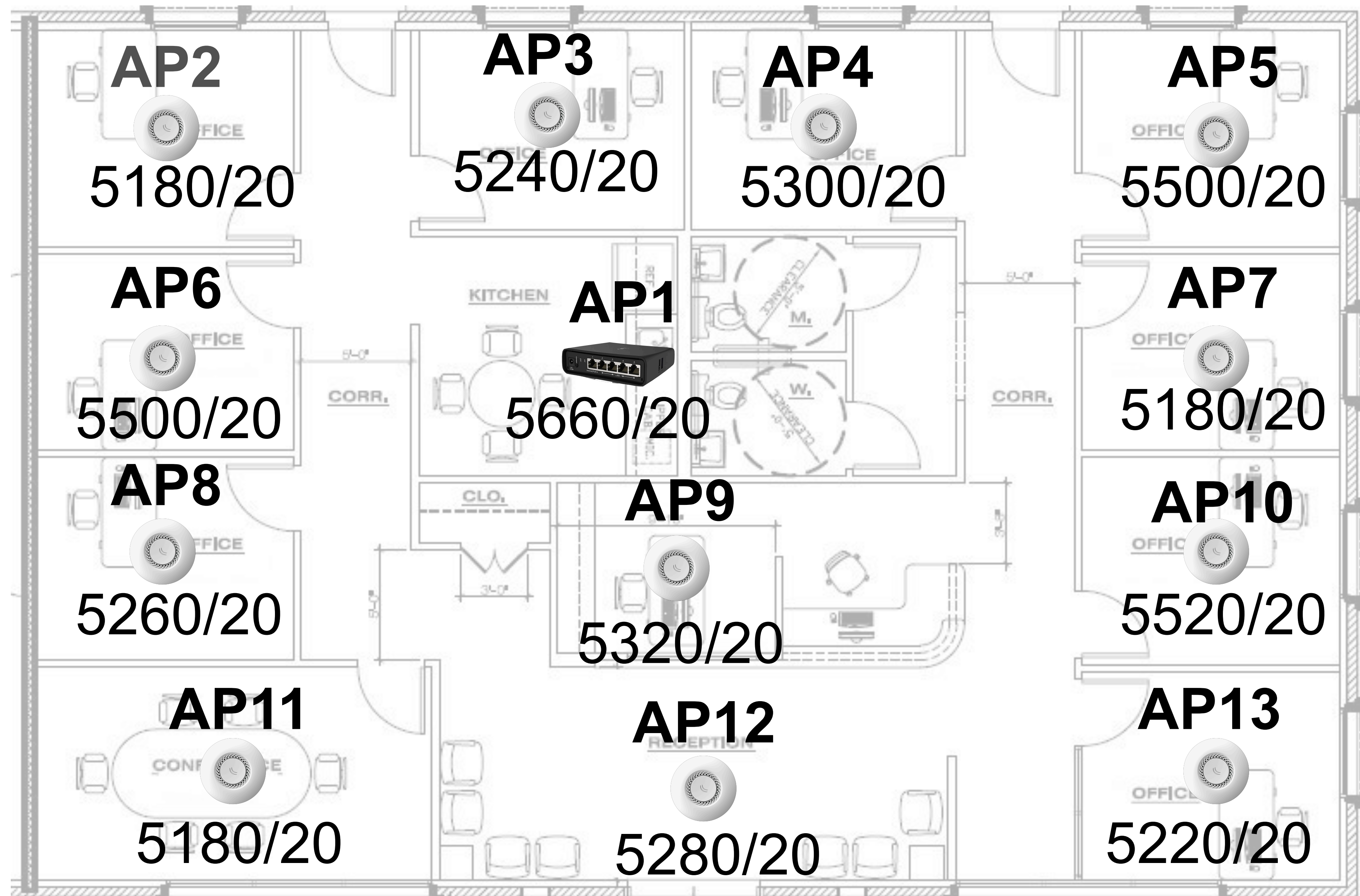
MikroTik Consultant's suggestions

- Even fewer clients support the new Ofcom 5.8GHz Band B expansion - don't use it until client support is more forthcoming!
- or ensure you provide APs nearby on Band A as well (U-NII-1)

Suggested 2.4GHz Channel Plan



Suggested 5GHz Channel Plan



MikroTik Consultant's suggestions

- Clients can get 'sticky' and stay connected to an AP long after it should have disconnected itself and connected to a stronger / nearer AP
- Consider reducing the receivable range of an AP by increasing the lowest minimum basic data rate to 12Mbps or even 24Mbps
- With two or more APs consider using CAPsMAN

MikroTik Consultant's suggestions

- CAPsMAN provides one central configuration system
- Add or change a parameter in one place and all the APs will change within seconds
- Reduced maintenance overheads
- Simplified config on APs when placed in CAP mode
- Do not forget to secure and firewall CAPs!

MUM CAPsMAN Channel Config Examples

- `/caps-man channel`
`add band=2ghz-g/n control-channel-`
`width=20mhz extension-channel=disabled`
`frequency=2412 name=Ch1 tx-power=10`

`add band=5ghz-a/n/ac control-channel-`
`width=20mhz extension-channel=disabled`
`frequency=5180 name=Ch36_20M tx-power=20`

MUM CAPsMAN Data Rates Example Config

- `/caps-man rates`
`add name="GN Only - No B rates"`
`basic=6Mbps supported=6Mbps,9Mbps,12Mbps,`
`18Mbps,24Mbps,36Mbps,48Mbps,54Mbps`

MUM CAPsMAN Security Example Config

- ```
/caps-man security
add authentication-types=wpa2-psk
disable-pmkid=yes encryption=aes-ccm
group-encryption=aes-ccm
group-key-update=1h name="MUM Public"
passphrase=mikrotik
```

## MUM CAPsMAN datapath Config

- `/caps-man datapath  
add bridge=Wireless_Bridge  
local-forwarding=no name="MUM Public"`



## MUM CAPsMAN 2.4GHz Configuration Example

- ```
/caps-man configuration  
add country="united kingdom"  
datapath="MUM Public" mode=ap  
name="MUM Public 2.4GHz"  
rates="GN Only - No B rates"  
security="MUM Public" ssid=MUM
```

MUM CAPsMAN 5GHz Configuration Example

- `add country="united kingdom"`
`datapath="MUM Public" mode=ap`
`name="MUM Public 5GHz"`
`security="MUM Public" ssid=MUM`

MUM CAPsMAN 2.4GHz radios Provisioning Config

- `add action=create-enabled comment="2.4GHz
802.11g capable radios"
hw-supported-modes=g
master-configuration="MUM Public 2.4GHz"
name-format=prefix-identity
name-prefix="2.4GHz-"`

MUM CAPsMAN 5GHz radios Provisioning Config

- ```
/caps-man provisioning
add action=create-enabled comment="5GHz
802.11ac capable radios"
hw-supported-modes=ac
master-configuration="MUM Public 5GHz"
name-format=prefix-identity
name-prefix="5GHz-"
```

# MUM CAPsMAN CAPsMAN Server Config

- `/caps-man manager  
enabled=yes  
add disabled=no interface=Network-Bridge`

## MikroTik MUM WiFi

- Most of you connected today will be using MikroTik WiFi based on a CAPsMAN controller running on one of the hEX PoEs and dual band WAPac's interconnected using Wireless Wires on 60GHz
- 2.4GHz is lower power than 5GHz
- 2.4GHz and 5GHz channels are all on 20MHz



## MikroTik MUM WiFi

- A site survey was carried out before activating this system, to learn what channels were already in use, try to reduce interference by avoiding the hotel's existing system
- With the short amount of time we had to build and config, mistakes may happen - it won't be perfect!

## MikroTik MUM WiFi

- And one of the biggest impacts, will be the amount of backhaul speed provided by the hotel.
- If it works or not - do tell us. We'll be actively monitoring the performance with The Dude and tweaking settings throughout the day :)
- Come and see The Dude in action on the LinITX stand

# Thank You!