Avoiding Radio Channel Interference

The CLiKAPAD keypads use radio technology to communicate their votes to their corresponding base station. Many other items use very similar technology and interference from these other devices may cause issues with voting. The main issue that arises is a base station's range being reduced, which may mean that keypads further away from the base station may not get their votes counted. The following guide aims to tell you what causes the issue and how best to minimise the problem.

The interference will commonly come from sources such as mobile phones, WiFi and Bluetooth devices. Each signal operates on a channel, which is a band of frequencies within the 2.4GHz spectrum (2.400GHz- 2.477GHz). By dividing a larger frequency, you can target the "cleaner" channels to avoid any issues with interference arising before running the event.

The CLiKAPAD keypads operate on a number of discreet channels. Depending on which hardware you have, the channels are as follows:

Hardware Type	Available Channels
CB3 Series (CP31 & CP37 Keypads)	6 -> 77
Prioritizer	1 -> 77

These channels relate to a specific frequency within the 2.4GHz spectrum, shown below.

CLiKAPAD Channel	Specific Frequency (GHz)
1	2.401
2	2.402
3	2.403
…	…
75	2.475
76	2.476
77	2.477

WiFi uses its own channel designation, ranging from channel 1 to 14. Each channel has a centre point and typically covers a range of 22MHz, as shown by the below image. This only applies to WiFi operating on the 2.4GHz range. WiFi operating on 3.6GHz or 5GHz does not interfere with any CLiKAPAD hardware.
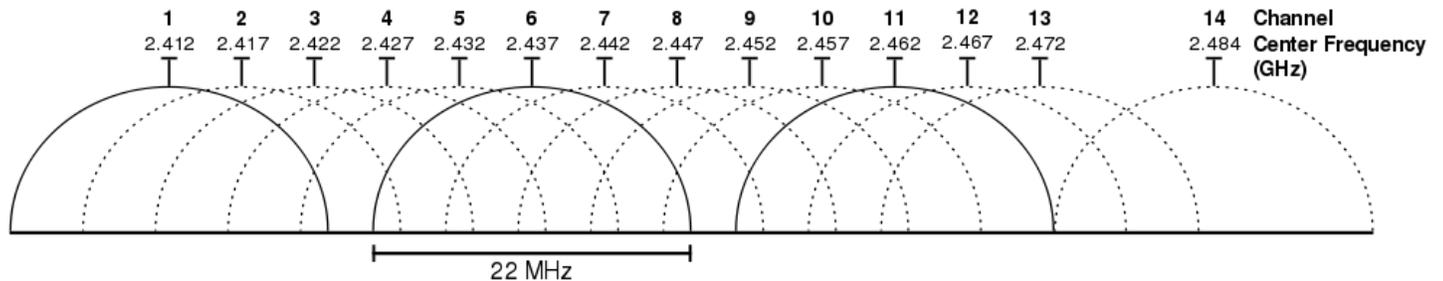
WiFi Channel	Recommended CLiKAPAD Channel No WiFi on this Channel	Interferes With CLiKAPAD Channels
1	6	6 to 23
2	17	6 to 28
3	22	11 to 33
4	27	16 to 38
5	32	21 to 43
6	37	26 to 48
7	42	31 to 53
8	47	36 to 58
9	52	41 to 63
10	57	46 to 68
11	62	51 to 73
12	67	56 to 75
13	75	61 to 75

In the above table the first column shows the WiFi channel. The second columns shows the recommended CLiKAPAD Channel to use if there is **no** WiFi on that channel (n.b. WiFi channels are very wide and overlap, so if WiFi channel 3 is clear, but WiFi channel 4 is in use avoid using CLiKAPAD Channel 22 as WiFi on channel 4 will interfere with this)

The third column shows the range of CLiKAPAD channels that a WiFi hotspot on this channel will interfere with, so avoid using these channels if possible if you see WiFi here.
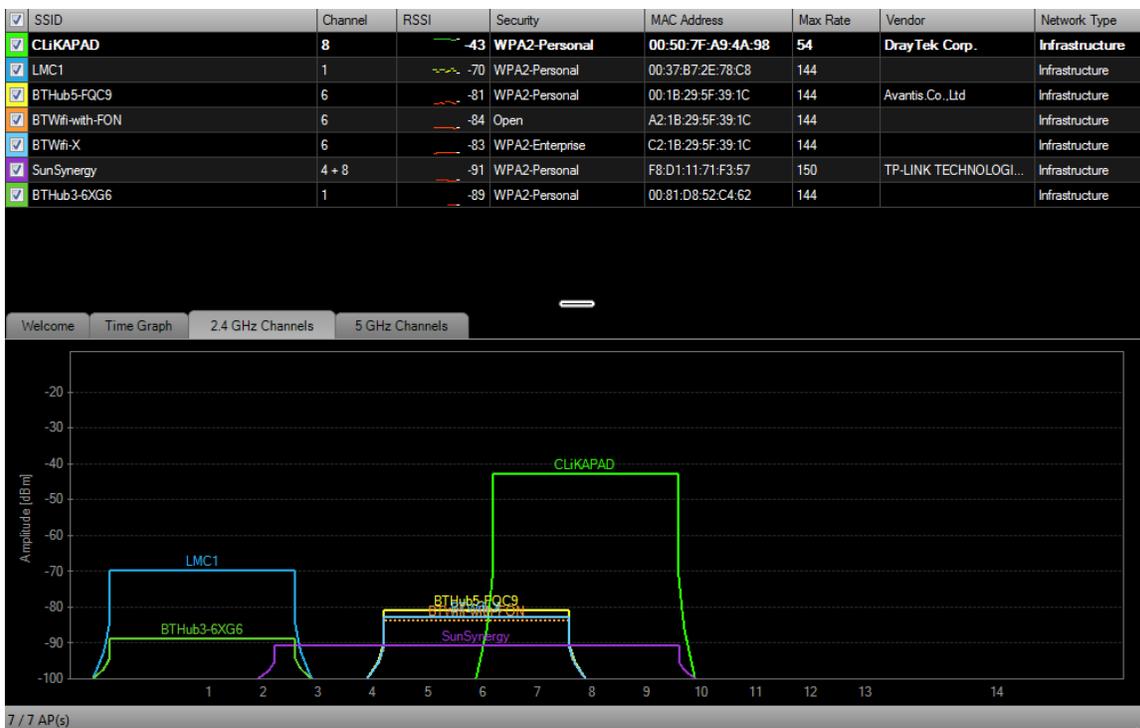
You will sometimes find WiFi in use on all channels, in this scenario you need to find you which WiFi hotspot is likely to be used - i.e. which WiFi hotspots are for use by the delegates/guests in the room and avoid using a CLiKAPAD channel that corresponds with this. A WiFi hotspot in itself does not cause interference, it is the WiFi hotspots that are in use that are the ones that will cause interference.

If it is possible it is always best to avoid any CLiKAPAD channel that overlaps with an active WiFi transmission. If that is not possible then using a channel at the edges of the WiFi band and not directly in it's center point.

Scanning for Active WiFi Hotspots

There is a free tool called inSSIDer available from www.metageek.com/products/inssider which uses the computer's onboard WiFi receiver to display all active WiFi hotspots and their respective channels. An example output from the inSSIDer software is shown below. There are also many free apps available for Android and iPhones

SSID	Channel	RSSI	Security	MAC Address	Max Rate	Vendor	Network Type
CLiKAPAD	8	-43	WPA2-Personal	00:50:7F:A9:4A:98	54	DrayTek Corp.	Infrastructure
LMC1	1	-70	WPA2-Personal	00:37:B7:2E:78:C8	144		Infrastructure
BTHub5-FQC9	6	-81	WPA2-Personal	00:1B:29:5F:39:1C	144	Avantis.Co.,Ltd	Infrastructure
BTWifi-with-FON	6	-84	Open	A2:1B:29:5F:39:1C	144		Infrastructure
BTWifi-X	6	-83	WPA2-Enterprise	C2:1B:29:5F:39:1C	144		Infrastructure
SunSynergy	4 + 8	-91	WPA2-Personal	F8:D1:11:71:F3:57	150	TP-LINK TECHNOLOGI...	Infrastructure
BTHub3-6XG6	1	-89	WPA2-Personal	00:81:D8:52:C4:62	144		Infrastructure

In this example, it can be seen that the WiFi networks currently active are using channels 1 to 8, remembering that the channel number relates to the centre of the frequency band not either end. The CLiKAPAD channel numbers that be best avoided would be channels 1 to 57, as WiFi channels 1 to 8 cover all of the frequencies between 2.401GHz and 2.457GHz.

WiFi Interference

To demonstrate the amount of interference to the 2.4GHz frequency channels that WiFi usage can cause, the images below show the difference between an unused WiFi hotspot and a WiFi connection that is downloading and uploading information. This is done using the Chanalyzer software and a WiSpy dongle.

The chart created has 3 variables, time along the Y axis, frequency along the X axis and the volume of traffic is indicated by the colour, where blue is a low lever of traffic and red is a high level.

The 15 second chart on the left shows a WiFi connection barely being used. There is a fair amount of inactivity, indicated by the large amount of dark blue in the background, with smaller large pieces of data being transmitted shown in green and red. However, the chart on the right shows a large amount of activity between the frequencies of 2.435GHz and 2.457GHz.
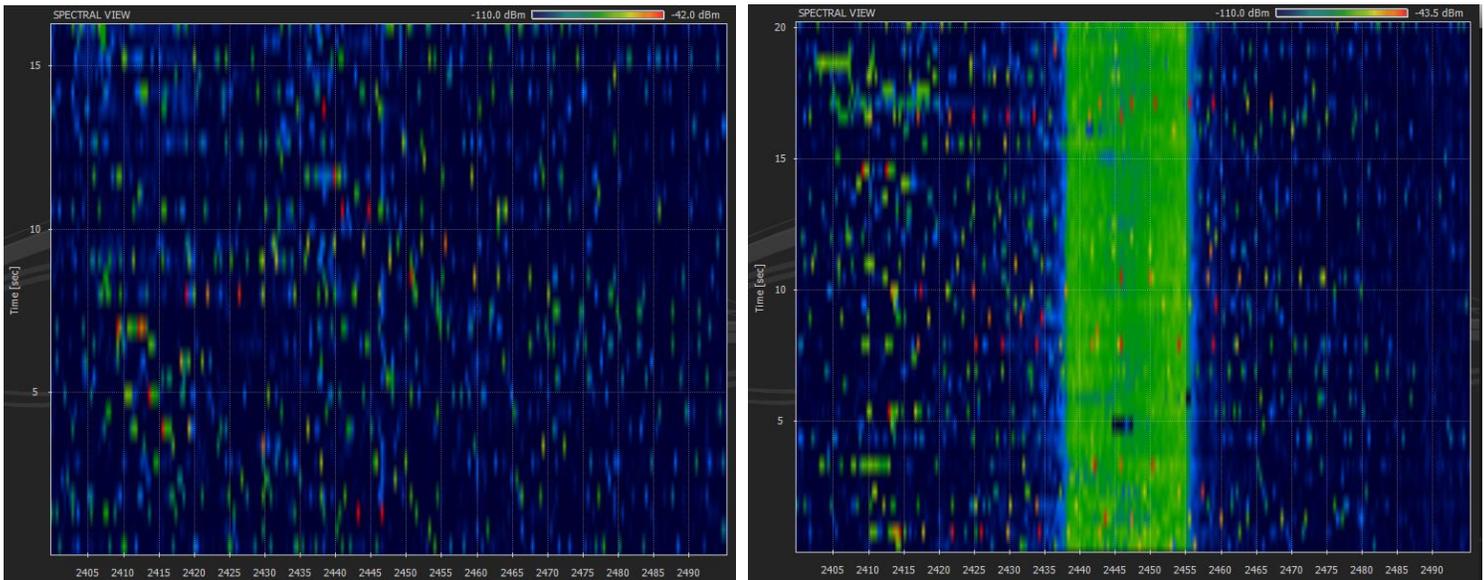
As we can see from the right hand chart, the CLiKAPAD channels of 35 to 57 have a very high level of traffic. If a vote was running on a channel between these two, the range of the base receiver would be reduced. By avoiding those channels, the interference from a WiFi signal can be marginalised as much as possible.