White Paper

Guidelines for providing structured cabling to Wireless Access Points

excel without compromise.

As a follow up to the two previous whitepapers on the topic of structured cabling and the next generation of Wireless Access Points (WAPs) - the first one published in 2015 when IEEE 802.11ac (which we will call WiFi 5 in this Whitepaper) was just starting to see mass market roll out and the second a year later that looked at the potential impact of the new more powerful and higher frequency access points interfering with the structured cabling that supports them. This latter one was produced in conjunction with De Montfort University in Leicester, UK.

What is WiFi 6 and what does it bring?

It is an upgrade on WiFi 5, which was a massive leap forward in Wireless Technology however the IEEE and the WiFi Alliance wanted to make several improvements focussed on its performance 'Typical' conditions rather than the previous model which was to look at data rates under 'perfect' conditions. One analogy describes this update as being a little like adding more lanes to the motorway as well as dedicated bus and carpool lanes to free up the traffic flow and reduce congestion.

How is this being achieved?

The most important new feature of WiFi 6 that allows it to have 4 times the throughput capacity of WiFi 5 is an enhanced multi-user feature called OFDMA (Orthogonal Frequency Division Multiple Access). Unlike previous models where devices competed, with the additional ability of being able to use both the 2.4GHz and 5GHz bands there is no contention as each device is simultaneously scheduled to transmit data in parallel.

The increase in the number of data packets that can be handled, especially real-time applications such as voice traffic, is effectively pooled allowing for multiple conversations at the same time.

Originally announced in WiFi 5, MU MIMO (Multi-User, Multiple Input/Multiple Output) has been enhanced to allow the WAP to handle up to 8 devices to transmit simultaneously, with each device having their own dedicated channel. This allows for large data packets such as streaming HD video to be handled more efficiently whilst shorter packets from IoT devices and Voice are handled by OFDMA.

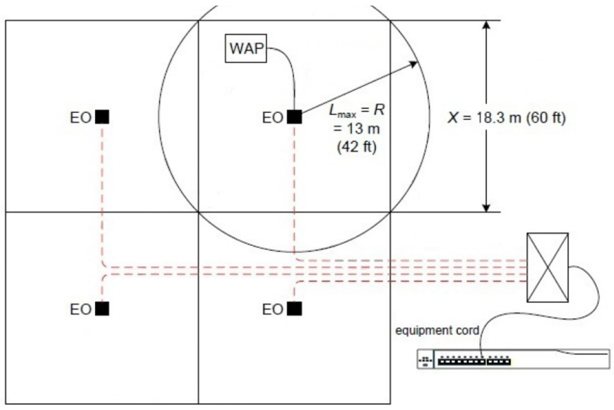
We have just mentioned IoT devices and at this moment almost no Whitepaper would be complete without touching on this topic, and on this subject, WiFi 6 has also had enhancements with an operating mode for low-power, low-bandwidth devices such as sensors, automation, and medical devices etc. This mode separates these devices into a 20MHz only channel operating in either the 2.4GHz or 5GHz bands and removes them from interfering with latency sensitive traffic.

This all sound great but there are some challenges that need to be overcome and they are down to the deployment and whether the existing Infrastructure can handle it. The good news is the cabling standards bodies have recognised these challenges and have not been slow to react.

The TIA started work on TSB 162-A which was published in 2013. At this point it is important to note what a TSB is. It is a Technical Service Bulletin. It is not a Standard but a guidance document. It was released before the full impact of WiFi 5 came to the fore. It is currently under revision and when published as TSB 162-B it will take account of WiFi 6 as well as WiFi 5. However, at this stage it is not known what the full details will be and how they intend to deal with coverage areas.

With both Cenelec and ISO they have already made changes to BS EN 50173-6 and ISO/IED 11801-6 – Distributed Building Services to include and take account for WiFi 5 and these will also cover WiFi 6, when they were published in 2018. Both these standards bodies have a common approach and common wording.

There are key differences between the approaches of TIA and the other two standards bodies, however. The one thing that is consistent is they all state the minimum category of cabling is Category 6A or Class EA. Furthermore, they are stated as requirements (not recommendations) to handle the higher data rates and power delivery requirements.



Typical Uniform Coverage Area Grid Pattern

Courtesy TSB 162-A

The main difference between them is regarding the cell size used to calculate the coverage area. TSB 162-A uses an 18.3m square cell with a maximum radial length of the equipment cord/ lead length of 13m. Give the greater insertion loss of the latter the permanent link length is now reduced to 80m from 90 an important factor that will be missed by many.

They also list several factors that will impact the wireless coverage such as occupancy, building construction and materials etc. Whilst it does also discuss whether the WAP is installed above or below the ceiling they do not cover ceiling height. Cenelec and ISO state that placing WAPs on a ceiling that exceeds 3m in height can result in a lower coverage area radius at floor height.

Therefore, this is one of the reasons that BS EN 50173-6 and ISO/IEC 11801-6 have both agreed to use a slightly different approach. They not only work with a smaller cell size, they are also hexagonal. This 'Honeycomb' grid provides the most efficient coverage.

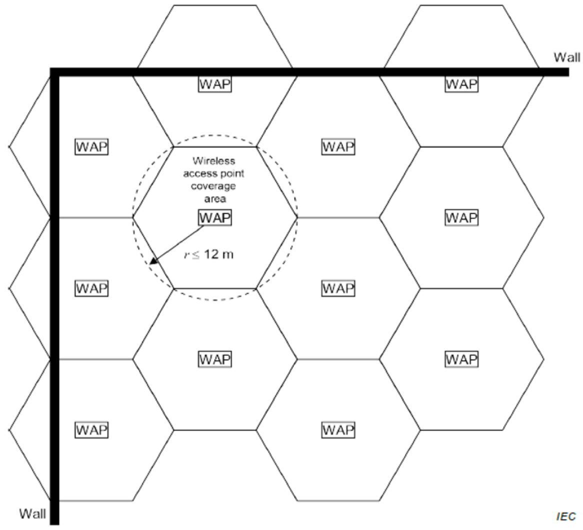


Figure A.1 – Wireless application coverage area grid

It is assumed the wireless access point has an optimal indoor range of 12m as seen in Table B.1 of BS EN 50173-6.

B.2.11.1 General

This section is applicable to, but not restricted to, the wireless applications listed in Table B.1. Certain proprietary wireless equipment has a typical indoor range less than 12 m.

Table B.1 — Supported wireless applications

Application	Standard Description	Typical indoor range (radius)
IEEE 802.11	Wireless Local Area Networks (2 Mbit/s at 2,4 GHz or infrared)	30 m
IEEE 802.11a	Wireless Local Area Networks (54 Mbit/s at 5 GHz)	12 m
IEEE 802.11b	Wireless Local Area Networks (11 Mbit/s at 2,4 GHz)	30 m
IEEE 802.11g	Wireless Local Area Networks (54 Mbit/s at 2,4 GHz)	12 m
IEEE 802.11n	Wireless Local Area Networks (600 Mbit/s at 2,4 and/or 5 GHz)	12 m
IEEE 802.11ac	Wireless Local Area Networks (7 Gbit/s at 5 GHz)	12 m
DECT	Digital European Cordless Telephony (1 Mbit/s at 1,8 GHz)	50 m
Bluetooth II	ISM Band 1 Mbit/s at 2,4 GHz	Up to 10 m

It is also based on having the WAP close to the service outlet it is connected to. In contrast TSB 162-A allows for it to be up to 13m away from the outlet serving it. This approach introduces the opportunity for less than an ideal design and subsequent poor coverage.

Cenelec and ISO go even further by making additional recommendations looking to the future, firstly if MU-MIMO is implemented or service redundancy is needed more Service Outlets should be installed in each coverage area.

On top of this, Indoor Positioning systems that use WAPs or RFID need a dense network of antennas to enable connection from at least three antennas for accuracy.

Conclusions

At the time of writing this Whitepaper TSB 162 is under revision and a range of improvements will be made. However, BS EN 50173-6 and ISO/IEC 11801-6 – Distributed Building Services are certainly the standards to work with when looking to install an infrastructure to support WiFi 6 as there are definitive safety margins built into them.

As an aside some proponents of WiFi 6 such as the WiFi Alliance are quick to promote the potential benefits of the technology in supporting IIoT (Industrial Internet of Things). Whilst this is a valid opportunity, I believe it will be a combination of WiFi 6 and Single Pair Ethernet that will drive the forecast explosion in connected devices. The simple fact of this is 'Remote Power'. For more details please see our **recent Whitepaper on Single Pair Ethernet.**

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