# MobileMark
### antenna solutions

# WiFi 6E

WiFi over the years has reached the status of a required utility. Nearly every smart device on the market depends on WiFi for interconnection and access to the Worldwide Web. Through the years WiFi has received continuous improvements and enhancements in the modulation protocols and expansion of available spectrum. With the release of WiFi 6E, the latest generations of WiFi, the system received it largest allotment of new spectrum ever. On April 23rd, 2020 the FCC adopted new rules that opened 1200 MHz of new unlicensed spectrum in the 6 GHz band, creating WiFi 6E. The new band has a contiguous range of 5.925 to 7.125 GHz. This allocation not only allows many narrower band WiFi channels but also allows new wideband 160 MHz channels for very high-speed data transfer.

# THE WIFI EVOLUTION

| Generation | Standard | Year | Band | Max. Data Rate | MIMO |
|---|---|---|---|---|---|
| WiFi 1 | 802.11b | 1999 | 2.4 GHz | 11 Mbit/s | No |
| WiFi 2 | 802.11a | 1999 | 5 GHz | 54 Mbit/s | No |
| WiFi 3 | 802.11g | 2003 | 2.4 GHz | 54 Mbit/s | No |
| WiFi 4 | 802.11n | 2009 | 2.4 / 5 GHz | 600 Mbit/s | 2x2 |
| WiFi 5 | 802.11ac | 2014 | 5 GHz | 6933 Mbit/s | MU-MIMO 4x |
| WiFi 6 | 802.11ax | 2019 | 2.4 / 5 GHz | 9608 Mbit/s | MU-MIMO 8x |
| WiFi 6E | 802.11ax | 2020 | 2.4 / 5 / 6 GHz | 9608 Mbit/s | MU-MIMO 8x |



## MU-MIMO

MU-MIMO (Multi-User, Multi-Input, Multi-Output) was first introduced in WiFi 5 applications brought into use under IEEE 802.11ac. Since then it has been used in WiFi 6 and brings benefits to the 2.4 GHz band. With the addition of the new 6 GHz band MU-MIMO can really shine.

MU-MIMO allows multiple data streams to be transmitted from the router to the connected devices which increases the data rate significantly.

In WiFi 5, a maximum of 4 data streams could be transmitted simultaneously. These streams could be directed to up to 4 users, or if the user's device had MIMO capability it could direct the appropriate number of streams to that user. For example, If 3 users attempt to receive data from the router, and two of which were SISO (Single Input, Single Output) devices and the third user had a 2x3 MIMO device, the router could allocate 2 data streams to the 2x2 user and one stream each to the two SISO user simultaneously. This offers optimum data streams to all three users devices on the 5 GHz band.

For WiFi 6 the maximum numbers of data streams which can be simultaneously transmitted is increased to 8 streams, therefore more users in SISO and 2x2 MIMO modes can be addressed, or

users with newer 4x4 devices can be handled. In addition to the 8 concurrent data streams WiFi 6 also introduced the ability of the router/access point to use either 2.4 or 5 GHz. In fact, smart routers can output data streams on both to the same user.

WiFi 6E now brings the addition of the 6 GHz band into the mix. The router / access point can use one, two, or all three bands to send data streams to the user's device. Another feature 6E has is the 1200 MHz of spectrum. This allow use of the wider 160 MHz channel bandwidth which enables the data packets to be long. Net outcome is more data sent to the user's device in the same amount of time.

WiFi has progressed from a low speed system to wireless connect accessories to a LAN based computer to a high speed / broadband / multi-stream data system. Along with the current features brought to us in the WiFi 6 and WiFi 6E, we see more use of other enhancements like Mesh Networking which helps to build our WiFi networks into very robust and high-speed workhorses.

The future is wide open, what will WiFi 7 look like?

Jerry Posluszny,
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