802.11 fundamentals: Modulation

802.11 WiFi can use different digital modulation schemes for data transmission. Environmental factors and protocol will define scheme selection. Below, we look at the principles behind modulation.

802.11g

BPSK is used for lower bit rates with 802.11g clients. A low bit-rate would be negotiated for many reasons, those discussed later in the document. BPSK paired with half rate encoding, results in a bit-rate of 6Mbps. 9Mbps is achieved with BPSK and 3/4 code rate.

If the signal strength exceeds the receiver sensitivity, a more complicated modulation scheme can be used. 802.11g can use up to 64QAM which uses both phase and amplitude modulation coherently, achieving 48Mbps and 54Mbps with a code rate of half and 3/4 respectively. An example constellation diagram for 64QAM is shown below.
### Factors that contribute to Negotiation of the Modulation Scheme

The benefit to a modulation scheme that has more states is that each state can represent more bits. In turn, the carrier needs to be modulated less often in order to transmit the same amount with a more complex modulation scheme, as it does for a less complicated modulation scheme. The caveat to using a more complicated modulation scheme is that the signal is more prone to error. Since the states are much closer together than that of less complicated modulation schemes, the detection of the states is much easier for the receiver.
RF noise is just a part of what could cause the modulation error and why a more complicated modulation scheme wouldn't be used.