Bounds on the capacity of OFDM underspread frequency selective fading channels

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The analysis of the channel capacity in the absence of prior channel knowledge (noncoherent channel) has gained increasing interest in recent years, but it is still unknown for the general case. In this paper we derive bounds on the capacity of the noncoherent, underspread complex Gaussian, orthogonal frequency division multiplexing (OFDM), wide sense stationary channel with uncorrelated scattering (WSSUS), under a peak power constraint or a constraint on the second and fourth moments of the transmitted signal. These bounds are characterized only by the system signal-to-noise ratio (SNR) and by a newly defined quantity termed effective coherence time. Analysis of the effective coherence time reveals that it can be interpreted as the length of a block in the block fading model in which a system with the same SNR will achieve the same capacity as in the analyzed channel. Unlike commonly used coherence time definitions, it is shown that the effective coherence time depends on the SNR, and is a nonincreasing function of it. We show that for low SNR the capacity is proportional to the effective coherence time, while for higher SNR the coherent channel capacity can be achieved provided that the effective coherence time is large enough.

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