A novel multi-carrier waveform with high spectral efficiency: semi-orthogonal frequency division multiplexing

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***Abstract*—In this paper, semi-orthogonal frequency multiplexing (SOFDM) is proposed, which has doubled spectral efficiency over OFDM by halving the subcarrier spacing. SOFDM is orthogonal in real field but non-orthogonal in complex field. To cancel the inter carrier interference caused by non-orthogonality, linear equalization algorithms are introduced based on inter carrier cross-correlation matrix. However SOFDM still suffer a performance loss due to the white noise power amplification effect of linear equalization. To further improve the performance, by use of the special property of inter carrier cross-correlation matrix, complementary SOFDM is provided, which is orthogonal in both real and complex field. It has identical spectral efficiency with OFDM but obtain a diversity gain in fading channel. And a HARQ-style flexible complementary SOFDM is introduced, which can obtain not only performance gain but also spectral efficiency gain.**

***Keyword*—semi-orthogonal frequency division multiplexing; inter carrier cross-correlation; inter carrier inference; zero forcing; minimum mean square error**

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