Broadband RF Power Amplifier Architectures for Linear Concurrent Signal Transmission

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Radar and communications applications require linear and efficient power amplification of signals to maintain information fidelity, and minimize heat generation, during transmission. These applications are increasingly taking advantage of multiple simultaneous, or concurrent, signals to improve performance. Multi-band radar, for example, has the added benefit of improved tracking range, while 5G communications improves data transfer rates through the use of carrier aggregation. However, efficient amplification of a single signal requires the power amplifier to operate in a non-linear fashion, with signal mixing of concurrent signals further degrading linear operation. This presentation covers two scenarios:

One, if the concurrent signal bands are known and fixed, a dual-band or multi-band power amplifier approach is a relatively simple solution to efficiently and linearly amplifiy concurrent signals. Employing multi-dimensional digital pre-distortion further improves linearity in the concurrent case.

Two, for true concurrent wideband operation, a novel power amplifier architecture is developed by combining two relatively narrowband power amplifiers with appropriately designed diplexers to cover a greater aggregate frequency bandwidth. Complex multi-dimensional digital pre-distortion techniques are not necessarily required to achieve similar levels of linearity.

This presentation will include several different types of broadband power amplifiers for these two scenarios, in hybrid or MMIC implementations, utilizing GaAs or GaN technology, each operating within a subset of 2-18 GHz. An in-depth comparison between these architectures is presented, adding to other comparisons found in literature from similar state-of-the-art designs. By considering the fundamental, harmonic, and intermodulation frequency content as a function of output power, multi-dimensional data sets can be generated to visualize concurrent power amplifier performance in an intuitive way.