

SIC HIGH EFFICIENCY WIDEBAND POWER AMPLIFIERS

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The Joint Tactical Radio System (JTRS) program of the United States Department of Defense (DoD) is to develop a family of software programmable radios that function from 2 2800 MHz, and are designed to provide reliable multi-channel voice, data, imagery, and video communications - and eliminate communications problems caused by "stovepipe" legacy systems. The radios support a number of legacy (e.g., FM) and advanced (e.g., Wideband Networking Waveform, a.k.a., WNW) waveforms. The radios are of different form factors, ranging from handheld versions with up to 5W RF output to rack-mounted versions with more than 100W RF output.

Many JTRS radios, especially the small form factor (SFF) versions will have a single RF power amplifier (PA) that supports a very wide bandwidth, typically exceeding several decades. Moreover, the SFF radios operate using batteries. The battery operation places a premium on power efficient sub-systems of the radio, primarily the PA, to extend mission operational time. The high efficiency requirement for the SFF radio PA is in addition to the other stringent requirements required of all JTRS PAs, namely linearity, wide bandwidth, and very low spurious and harmonics.

Highly efficient power amplifiers are currently available, and have been designed for narrowband niche applications such as mobile base stations and DoD narrow band radios. The design of wideband power amplifiers is a challenge, especially when coupled with stringent linearity requirements. Typically, Class A amplifiers offer the highest linearity albeit, with reduced efficiency. Classes AB, B, C, D, and F offer increasing efficiencies with corresponding decrease in linearity. Classes AB and B amplifiers offer a compromise between efficiency and linearity when operated in a push-pull mode. Class B push-pull amplifiers offer a theoretical efficiency of 78.5% (at saturation) and have the additional benefit of reducing all even order modes. Further, these amplifiers provide broader bandwidth than single ended amplifiers. The use of a linearizer provides an additional degree of control over the linearity of the power amplifier module. These linearizers provide a pre-distorted signal to the power amplifier input, such that the amplifier output is linear.

Sarnoff Corporation is currently developing a 20W High Power Amplifier (HPA) as a Line Replaceable Unit (LRU) for the JTRS radios. Our HPA utilizes silicon carbide (SiC) HEMTs in a Class AB Push-Pull configuration, to achieve high efficiency, linearity, and wide bandwidth. Preliminary measured results show that more than 50% power added efficiency (PAE) can be achieved for multi-octave bandwidth. Inter-modulation distortion (IMD) less than 20-dBc for up to P1dB of the PA is achieved without the use of any linearizers. Additional design details and measured results of the HPA, including the linearizer will be presented at the conference.

Abstract Submission Form

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