Knowledge Transfer Office
香港城市大學
City University of Hong Kong

Wideband Doherty Amplifier with High Efficiency

Communications & Information

Digital Broadcasting, Telecommunication and Optoelectronics

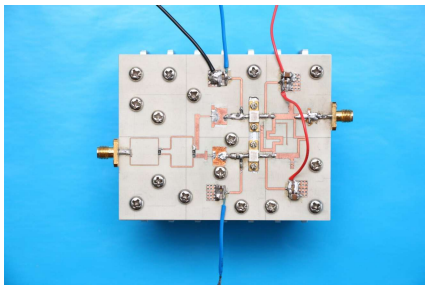

Fig. 1: Photo of the fabricated proposed DPA.

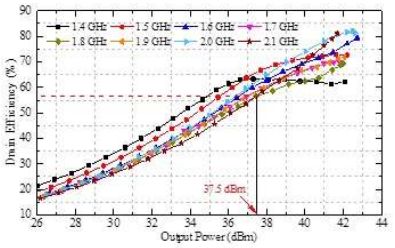

Fig. 2 Measured drain efficiency versus output power under modulated signals excitation.

IP Status
Patent granted

Technology Readiness Level (TRL) 4

Inventor(s)
Prof. CHAN Wing Shing
Prof. HO Derek
Dr. ZHOU Xinyu
Dr. ZHENG Shaoyong
Enquiry: kto@cityu.edu.hk

Opportunity

Doherty Amplifier since its invention in 1936 has been widely deployed because it can accommodate signals with high peak-to-average power ratio (PAPR) achieving high level of linearity and power efficiency. Modern day 4G and 5G wireless communication system requires large variation in instantaneous output power, as well as the adoption of multi-input multi output and carrier aggregation techniques, a broadband Doherty Power Amplifier (DPA) with high back-off efficiencies are urgently needed. This invention will provide that solution with the introduction of a Harmonic Injection Networks (HIN) to increase the Output Back-Off (OBO) range, together with a Phase Compensation Network (PCN) to maintain the wide bandwidth.

Technology

The main function of the invention is to achieve high efficiency Doherty power amplifiers (DPAs) over a wide frequency range. Specific gate biases (deep Class-AB and deep Class C) are used, which will give a very desirable high back-off efficiency and improved AM-PM distortion, but this leads to a reduction in the Output Back-Off (OBO) range. To mitigate the above problems, a Harmonic Injection Network (HIN) is proposed to enhance the OBO range. However, introducing this HIN results in a reduced bandwidth. Electrical coupling is then proposed for the Phase Compensation Network (PCN), which can effectively compensate for this reduced bandwidth. Careful combination of these complex interactions resulted in a DPA with wide bandwidth, high back-off efficiency and improved AM-PM distortion. A high-efficiency DPA prototype was designed based on two identical 10 W Gallium Nitride HEMTs. Measured results show that a drain efficiency greater than 60% is achieved at 5.3-6 dB output back-off power from 1.4 to 2.1 GHz.

Advantages

- DPA proposed DPA has a wide operating bandwidth (40%), which can cover the frequency band of 4G and many of the upcoming 5G.
- Has at least 60% efficiency at 6-dB back-off point
- Increased saturated output power
- Increased saturated efficiency
- Improved the AM-PM distortion performance

Applications

- Usable in different RF/Microwave/Wireless systems.
- Wireless Infrastructure market