A Comparison of Differential LC VCOs with Enhanced Tank Structure and Filtering Techniques in InGaP/GaAs HBT Technology

Sang-Yul Lee, Jae-Ho Yoon, Ah-Rah Koh, Bhanu Shrestha, *Sang-Hoon Cheon and Nam-Young Kim
RFIC Research and Education Center, Department of Electronic Engineering,
Kwangwoon University, Seoul, 139-701, Korea
E-mail : sanai530@kw.ac.kr
*Knowledge*on Inc.
513-37 Euyang-dong, Iksan 570-210, Korea

Abstract

This paper presents the InGaP/GaAs HBT diffential LC VCOswith low phase noise performance for adaptive feedback interference cancellation system AF-ICS). The VCOs are verified and comparied with different tank struture including filtering technique. The output tuning range for VCO2(using asymmetric inductor and symmetric capacitors with low pass filtering technique) is 138 MHz. The output powers are -0.565 at 1.486 GHz and 0.568 at 1.624 GHz. The phase noise of this VCO at 10 kHz, 100 kHz and 1 MHz are -88.95 dBc/Hz, -109.0 dBc/Hz and -129.0 dBc/Hz. The VCO is designed within total size of 0.9 × 0.9 ㎟

I. Introduction

To complete the predominant radio frequency commun-ication systems, integrated voltage controlled oscillators (VCOs) are very important parts of the system blocks. Nowadays differential topology is one of most polular techniques to improve the phase noise of the integrated LC VCOs. Thus, common building block in RF integrated circuit is differential pair of bipolar transistors.

This structure offers high loop gain making it common method to design differential voltage controlled oscillators (VCOs) in RFICs. For Hybrid VCO design, the traditional Colpitts LC topology is used to avoid the additional complexity that is like in differential VCOs design. For this reason, we could use just limited differential topology and modeling information.

An integrated VCO circuits offers reduced size and enhanced performance. Bisides, verified varactor diodes through proposed paper are used to tune the reference frequency. In addition to capacitive coupling feedback, a fully differential topology allows to reduce 1/f noise.

Additional LC filtering technique is used to enhanced the phase noise. The InGaP/GaAs HBT technology of Knowledge*on Inc. is used to design a fully differential VCO for adaptive feedback interface cancellation system (AF-ICS), which has low phase noise in this paper.

II. Circuit Design

In a transmitter repeater system, transmitted signal might be turned back to receiver like as any other received signal. This problem is base on spatial limitation of repeater system that can not separate Tx / Rx antenna.

For this reason, this feedback signal suppose to be canceled to protect repeater system and that is why adaptive Feedback Inteference Cancellation System (AF-ICS) is definitely required.

Figure 1 show a general block diagram of ICS in a ordinary wireless repeater system with inteference canceller.

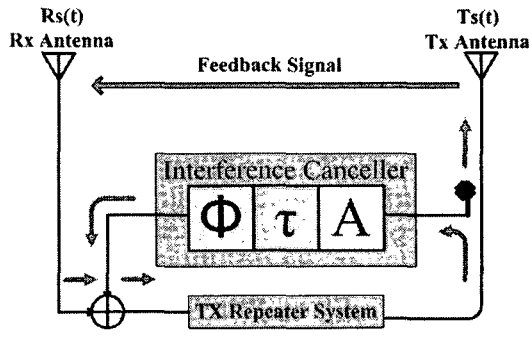

Fig. 1. The general ICS system block diagram