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Technology Offer

Current-Mode Receiver Architectures With High Linearity

Technology Overview

This technology offer relates to a novel architecture design of a current-mode receiver that can be applied to sub-6GHz 5G and 6G communication systems.
In almost all situations and circumstances, communication signal received by a receiver is often accompanied by some blockers and interferers from both in-band or out-of-band frequencies, which may result in driving the receiver into saturation.
A traditional solution to address such effect is to utilize a current-mode direct conversion design, which avoids large voltage amplification at the LNA output. Another solution is to employ mixer-first receiver architecture. With LNA absent, it avoids any possible voltage amplification brought by the LNA. Although the current-mode and mixer-first architectures have certain tolerance for the blockers and interferers, they can still be saturated, especially with large blocker strength.
To alleviate this problem, a novel true-current-mode receiver architecture is invented. The receiver starts with a matching network. The matching network have two options, as shown in Figure 1.

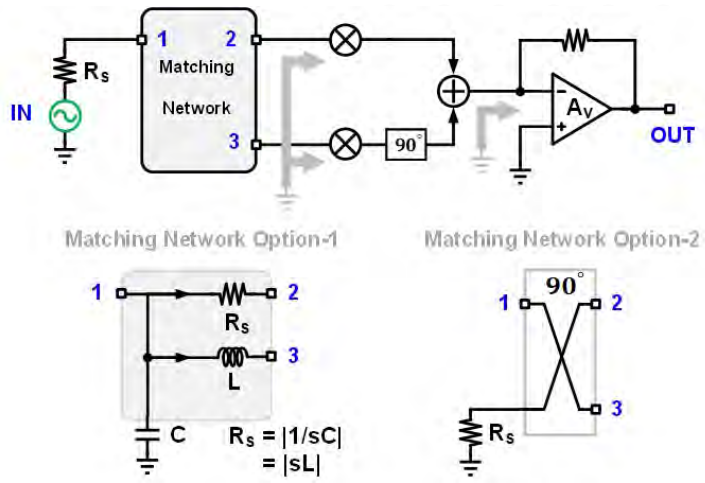

Figure 1: Architectures of proposed current-mode receiver with different matching networks

Technology Features / Specification

The key technical specifications of three receivers are listed below.

(Matching Network Option-1)	4.0-dB NF / 17-dB Gain / 24-dBm IIP3 / 18-mW
(Matching Network Option-2)	4.8-dB NF / 23-dB Gain / 17-dBm IIP3 / 18-mW

Potential Applications

Firstly, this invention can be used in sub-6 GHz, 5G, and 6G receivers. With only one inductor or transformer utilized, it saves lots of chip area and cost.
Secondly, the invented receiver is suitable for SAW-less applications.
Thirdly, the invented receiver deals well with input signal with large signal strength. It shows a large dynamic range.

Benefits

There are two main benefits of the proposed true-current-mode receiver.
The first benefit is that they all show high linearity, which improves their tolerance to blockers significantly, making it to be suitable for highly dense wireless applications. The IIP3 is around 20 dBm. The simulated P_{1dB} compared to that of the mixer-first receiver is provided in Figure 2. For out-of-band, the P_{1dB} of proposed receiver is 7 dB larger than that of a typical mixer-first receiver.

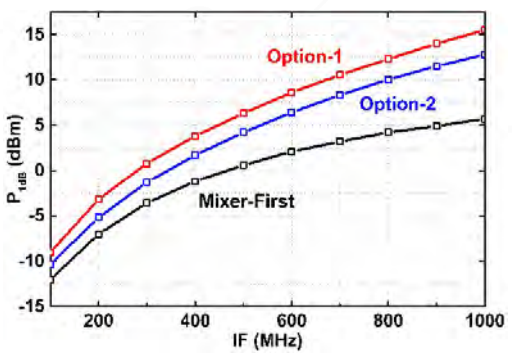

Figure 2: Simulated P_{1dB} of proposed receiver compared to that of the popular mixer-first receiver

Please contact A/Prof. Boon Chirn Chye (NTU) for further discussions on this technology.

Connected Smart Mobility Programme
School of Electrical and Electronic Engineering
Nanyang Technological University
50, Nanyang Avenue, S2-B3b-10, Singapore 639798
(65) 6790 5468
cosmo@ntu.edu.sg