

# A Wide Locking Range Injection Locked Frequency Tripler Based on a Dual-band Voltage-controlled Oscillator

## Communications & Information

Digital Broadcasting, Telecommunication and Optoelectronics

Smart Mobility and Electric Vehicle

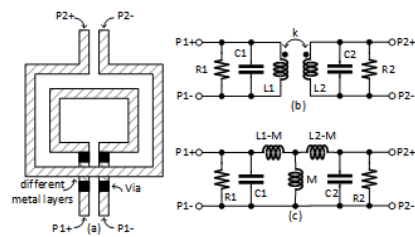


Figure 1. Planar transformer. (a) layout; (b) circuit model; (c) T-model.

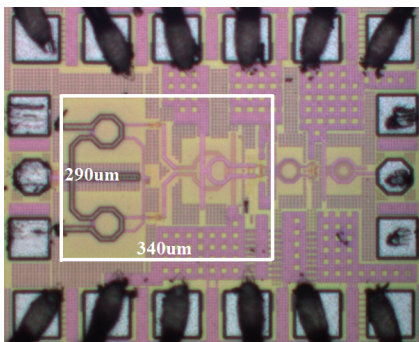


Figure 3. Chip photograph of the ILFT.

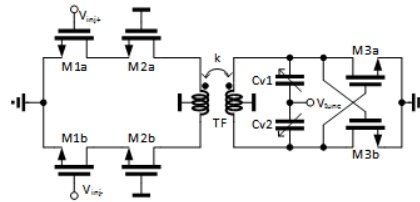


Figure 2. Schematic of the proposed wideband injection locked frequency tripler.

### IP Status

Patent granted



Technology Readiness Level (TRL) ?

4

Inventor(s)

Prof. CHAN Chi Hou

Dr. SHUM Kam Man

Dr. ZHOU Haifeng

Enquiry: kto@cityu.edu.hk

## Opportunity

Millimeter Wave applications have been the key propellers on many fronts like 5G, autonomous cars, medical and so forth. In the millimeter-wave frequency band, one of the key components is the local oscillator which provides a stable and pure oscillating source to transfer the signal to the targeted channel. Yet millimeter-wave operation with advanced digital CMOS nodes is still challenging. Traditional circuit topologies used for communications at lower frequencies ported to millimeter-wave frequencies typically either do not work properly or require a large power consumption. This invention provides a subharmonic injection locking that allows for high-frequency operations with relatively low power consumption. Since the injection locked frequency tripler has two locking ranges around the two resonant frequencies of the VCO, a wide locking range is achieved when these two locking ranges overlap.



## Technology

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## Advantages

- A wide locking range injection locked frequency tripler with easy control based on a dual-resonance transformer tank.
- The oscillation frequency can be forced to change easily which is quite different from the other dual-band oscillators.
- The coupling coefficient ( $k$ ) of the transformer can be selected to achieve an overlapping locking range of the injection-locked frequency tripler according to the required resonant frequencies.

## Applications

- 5G and 6G communications
- Autonomous car sensors

