

Introduction

❖ Topic

- Wireless Transceiver SOC for 60GHz WPAN

❖ Team member

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 - 60GHz LNA: D.H Kim
 - 60GHz Oscillator: J.Y Kim
 - 60GHz Mixer: M. Ko
 - High Speed MODEM: D.H Kim

❖ Sponsor

- 한국과학재단 특정기초 연구 – CMOS 기반 60GHz 광대역 송수신기 구현
- 서울시 신기술연구개발 지원사업 – 3Gbps급 밀리미터파 근거리 무선통신 송수신기

Introduction



- A network for interconnecting devices centered around an individual person's workspace

- **Typical WPAN range < 10m**

- IEEE 802.15.3 is one of WPAN standard
 - Data rate: 11, 22, 33, 44 and 55Mbps
 - Ad-hoc peer-to-peer networking
 - Security
 - Low power consumption
 - Low cost



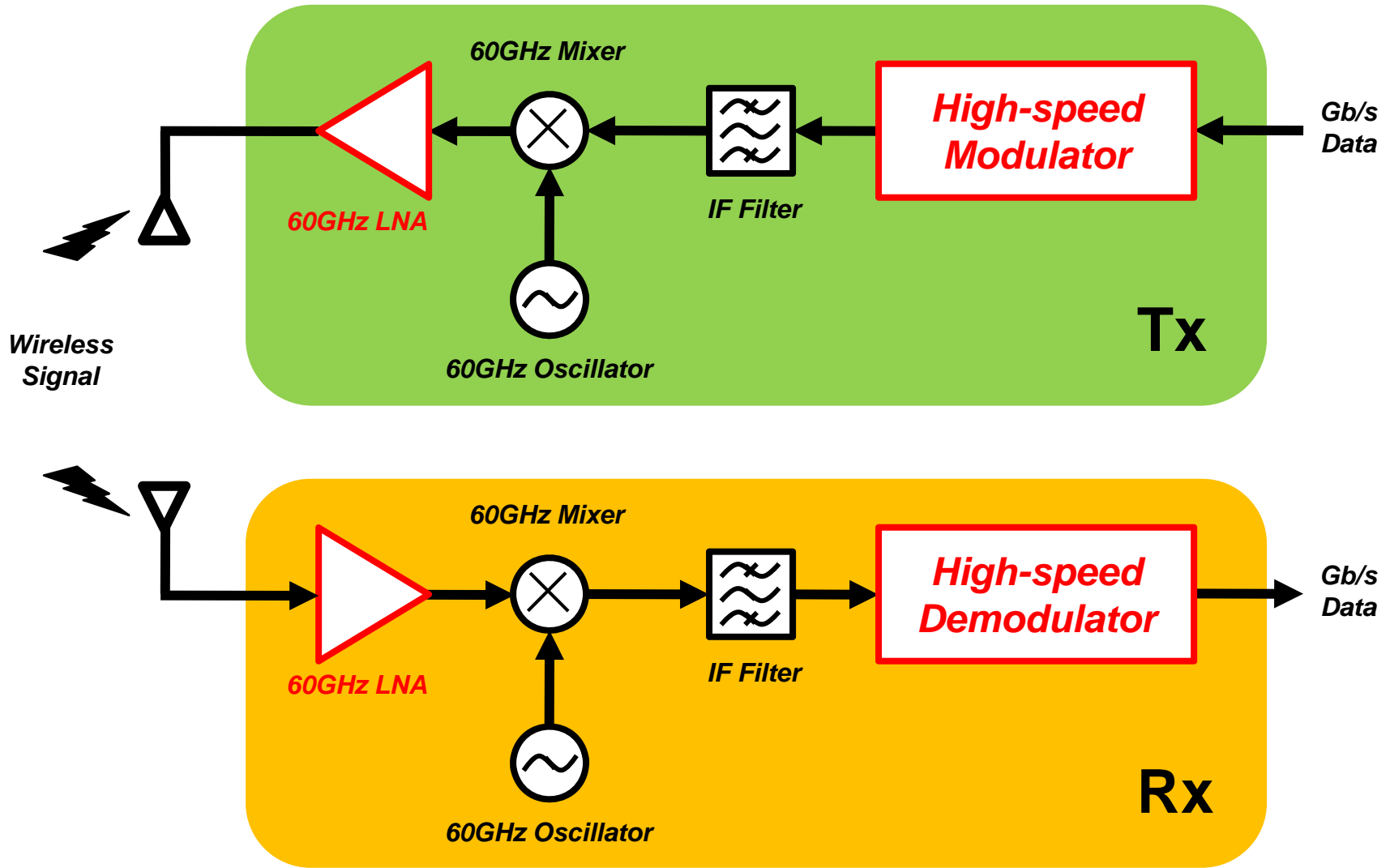
Demands for higher rate transmission (wireless HD video, wireless USB)



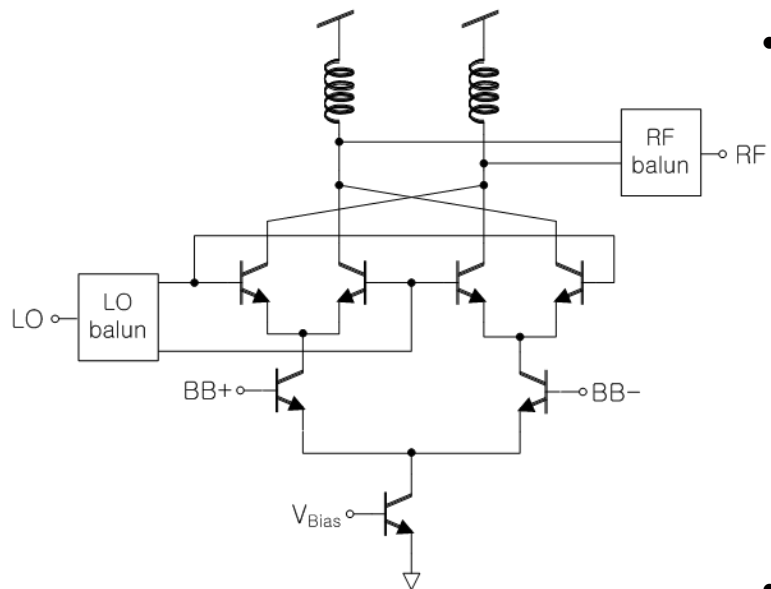
**Formation of IEEE 802.15.3c
Millimeter-wave WPAN for Gbps Tx**



Superheterodyne Receiver



60GHz SiGe Up-conversion Mixer

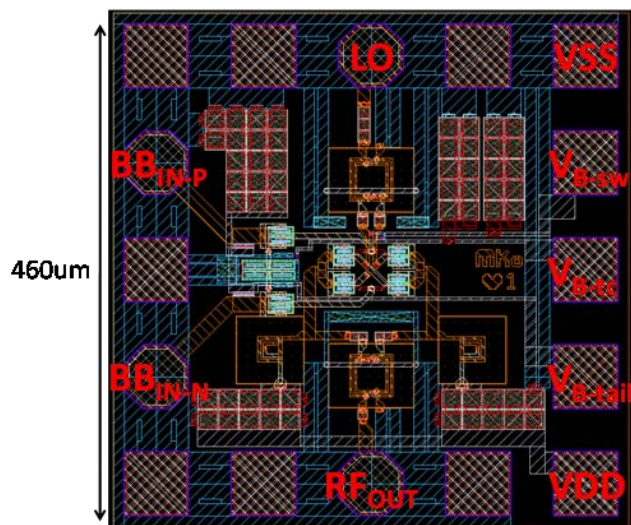


• Structure

- Gilbert-cell up-mixer
- Transformer-type LO&RF baluns for single-ended ports
- Stacked inductors for high Q and small footprint

• Target performance

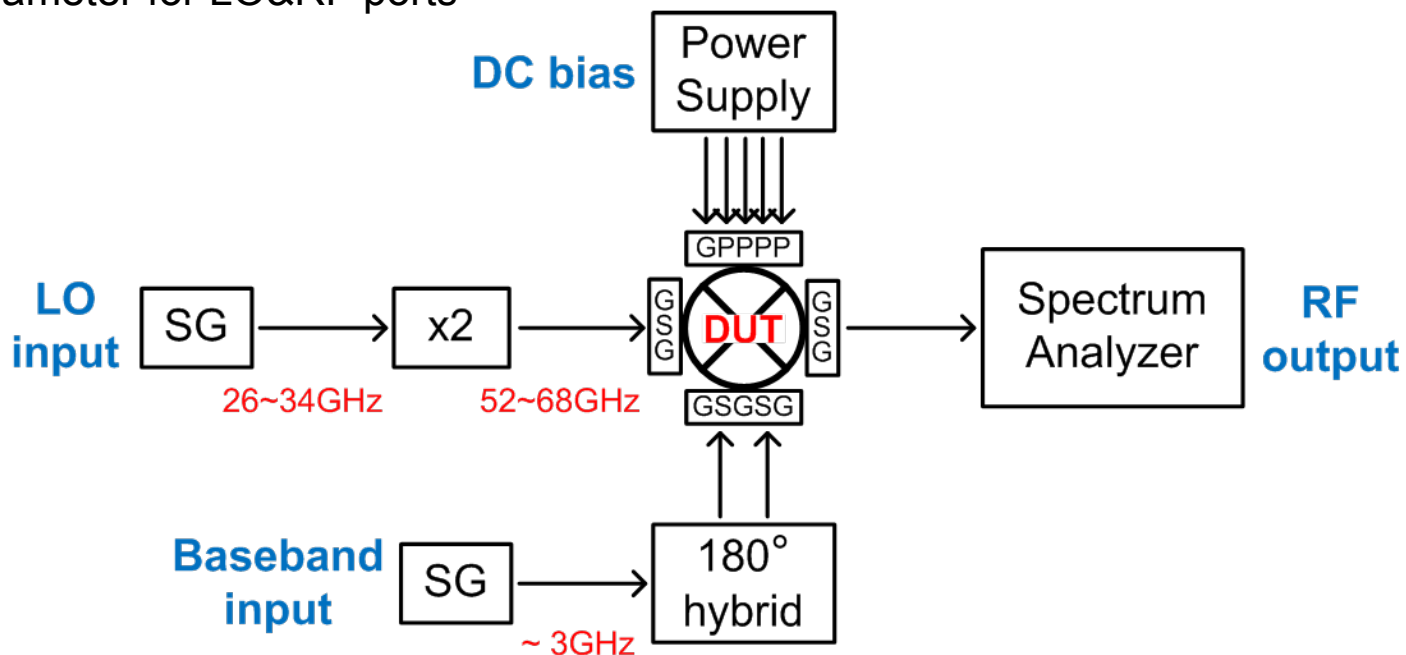
- RF freq.: 55 to 66 GHz
- BB freq.: DC to 2 GHz
- Conversion gain: 7 dB
- OP1dB: -10 dBm
- LO-RF isolation: 28 dB
- Power: 25 mW ($V_{DD} = 2.5$ V)



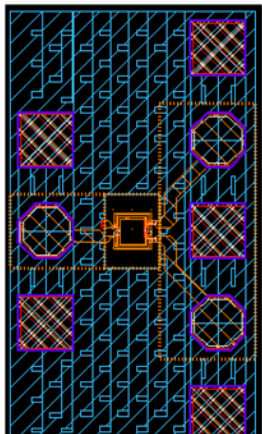
60GHz SiGe Up-conversion Mixer

• Measurement

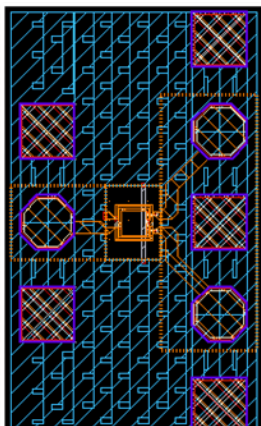
- On-wafer probing
- Single-ended LO&RF ports
- Power calibration at the probes
- Power/frequency control by signal generators
- 67GHz S-parameter for LO&RF ports



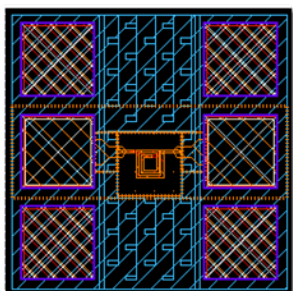
60GHz Passives



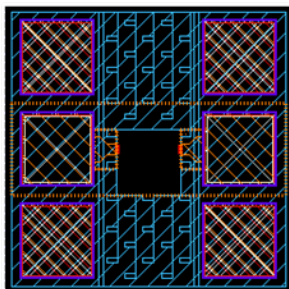
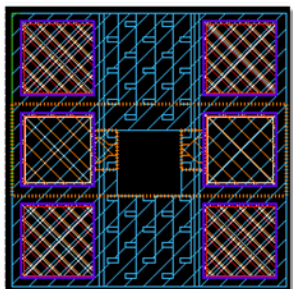
**Transformer balun
without center tap**



**Transformer balun
with center tap**



**300pH stacked
inductor &
OPEN/SHORT
structures**



- Goal

- Lumped passive components operated at 60 GHz
- Verification between measurements and EM simulation

- Measurement

- On-wafer probing

For balun

- 67GHz 2-port S-parameter
- 50Ω term for one of the differential ports

For inductor

- 67GHz 2-port S-parameter
- OPEN-SHORT deembedding