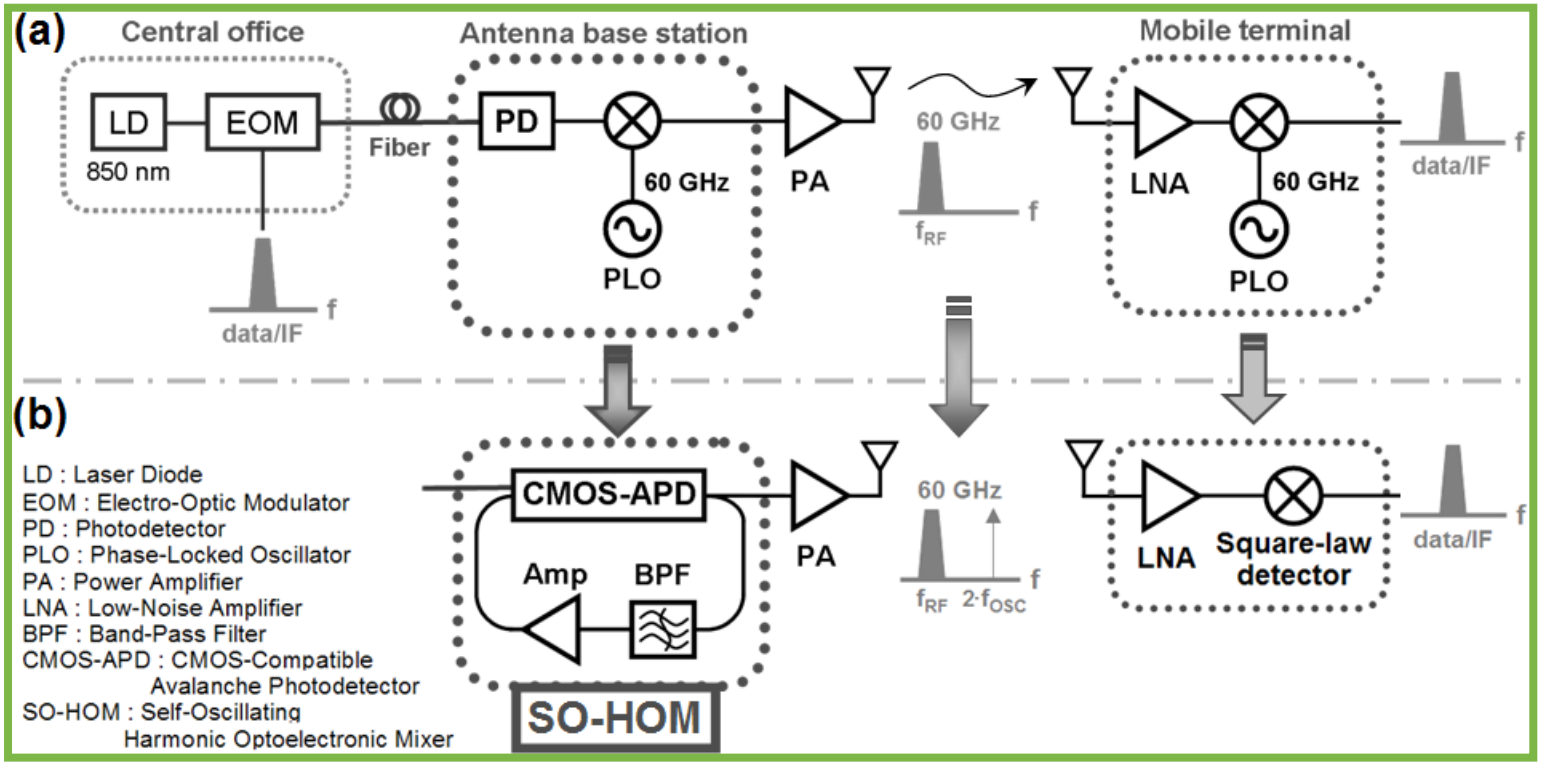
Introduction

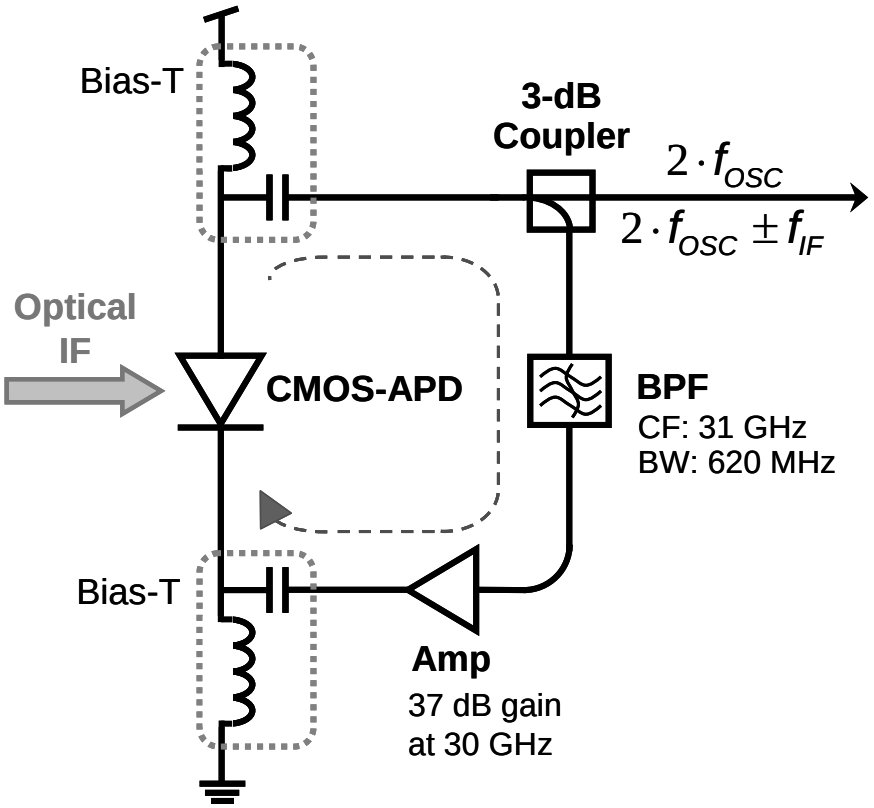
- Topic
  - Self-Oscillating Harmonic Optoelectronic Mixer Based on a CMOS-Compatible Avalanche Photodetector for Fiber-Fed 60-GHz Self-Heterodyne Systems
- Team member
  - Team member: M.-J. Lee, H.-S. Kang, and K.-H. Lee
- Sponsor

T-MTT



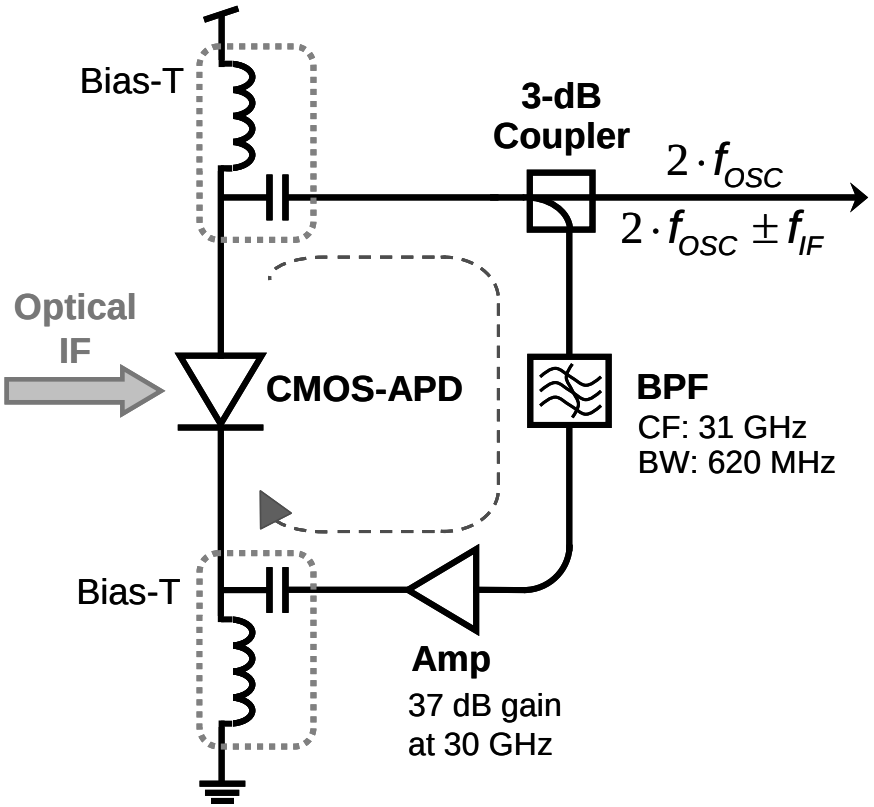
❖ (b) Configuration of a fiber-fed 60-GHz self-heterodyne system based on the self-oscillating harmonic optoelectronic mixer.

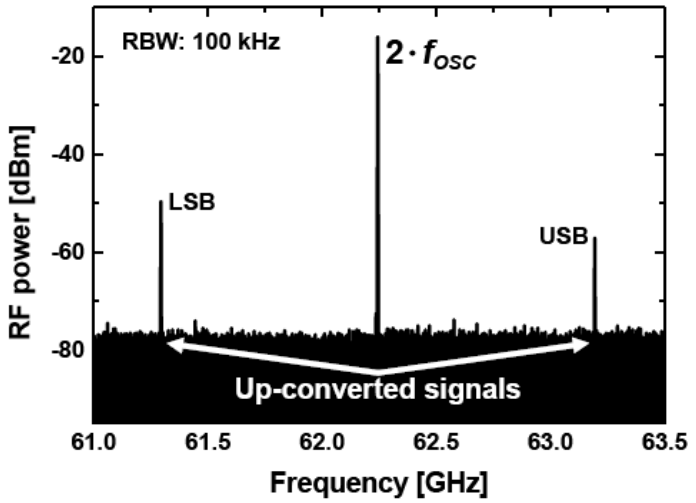
T-MTT

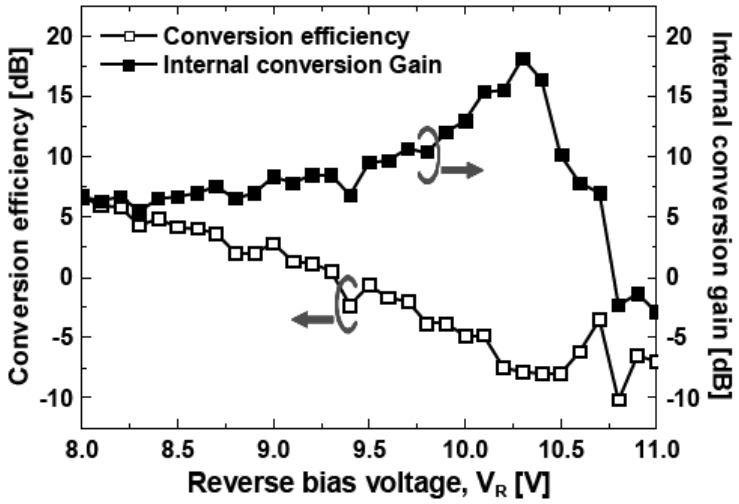


A self-oscillating harmonic optoelectronic mixer based on a CMOS-compatible avalanche photodetector for fiber-fed 60-GHz self-heterodyne systems is demonstrated. The mixer is composed of an avalanche photodetector fabricated with 0.18 ㎛ standard CMOS process and an electrical feedback loop for self oscillation. It simultaneously performs photodetection and frequency up-conversion of photodetected signals into the 2nd harmonic self-oscillation frequency band.

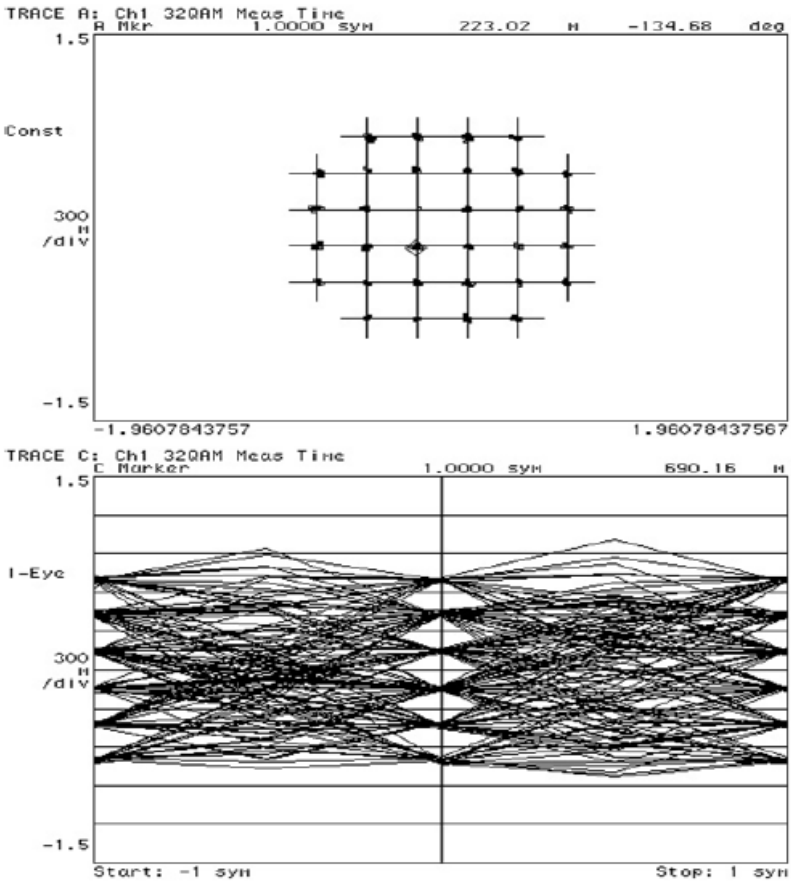
T-MTT


Bias-T
3-dB Coupler
$2 \cdot f_{OSC}$
$2 \cdot f_{OSC} \pm f_{IF}$
Optical IF
CMOS-APD
BPF
CF: 31 GHz
BW: 620 MHz
Bias-T
Amp
37 dB gain
at 30 GHz


RBW: 100 kHz
$2 \cdot f_{OSC}$
LSB
USB
Up-converted signals
RF power [dBm]
-20
-40
-60
-80
61.0
61.5
62.0
62.5
63.0
63.5
Frequency [GHz]


Conversion efficiency
Internal conversion Gain
Conversion efficiency [dB]
Internal conversion gain [dB]
20
15
10
5
0
-5
-10
8.0
8.5
9.0
9.5
10.0
10.5
11.0
Reverse bias voltage, V_R [V]

T-MTT



The CMOS-compatible avalanche photodetector and the self-oscillating harmonic optoelectronic mixer are characterized and analyzed, and the RF avalanche multiplication factor is measured and modeled. The performance of the mixer including up-converted signal power, conversion efficiency, and internal conversion gain is examined. Bias conditions are characterized and optimized for the best performance. Data transmission of 5 MS/s 32 QAM signals in a 60-GHz band is successfully performed with 1.83 % EVM and 30.7-dB signal-to-noise ratio.