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mm-Wave Circuit Design

Activities at EIT

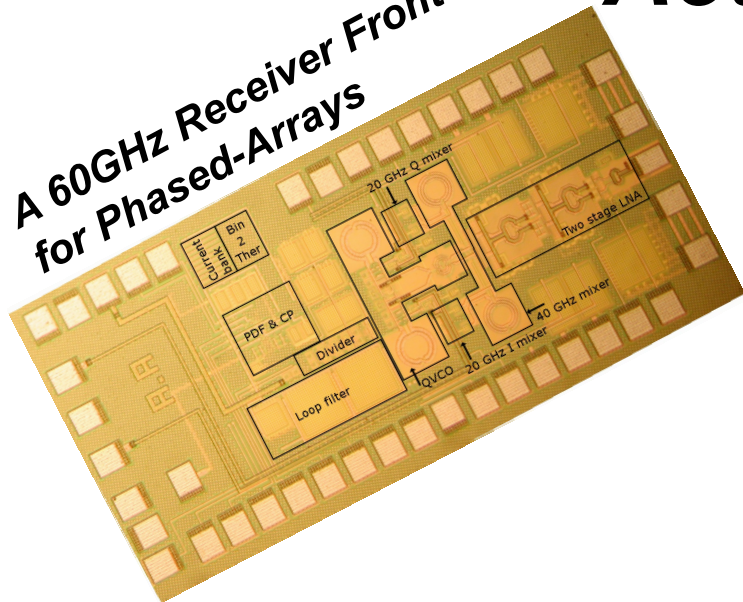
Markus Törmänen

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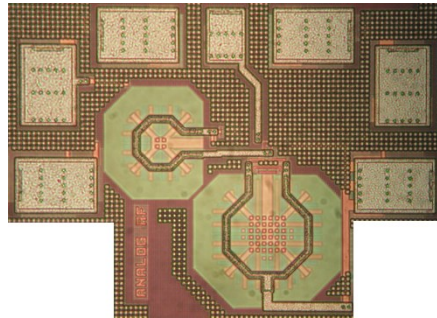


mm-Wave Circuit Design Activities at EIT

A 60GHz Receiver Front-End
for Phased-Arrays

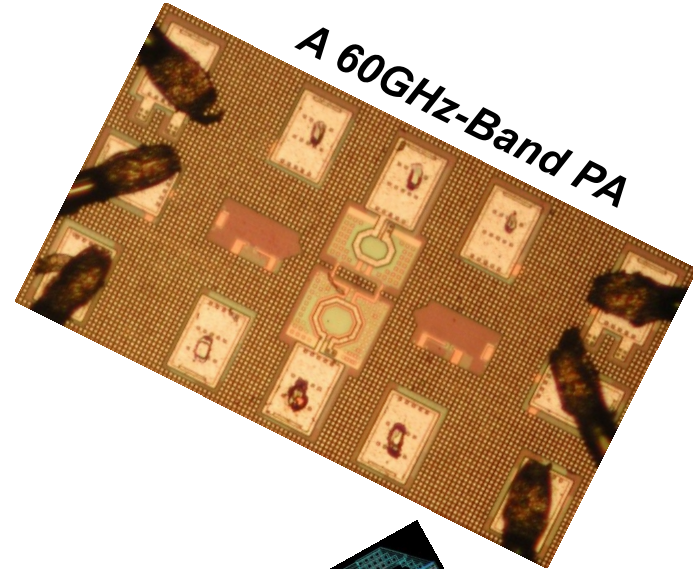


Recent and ...

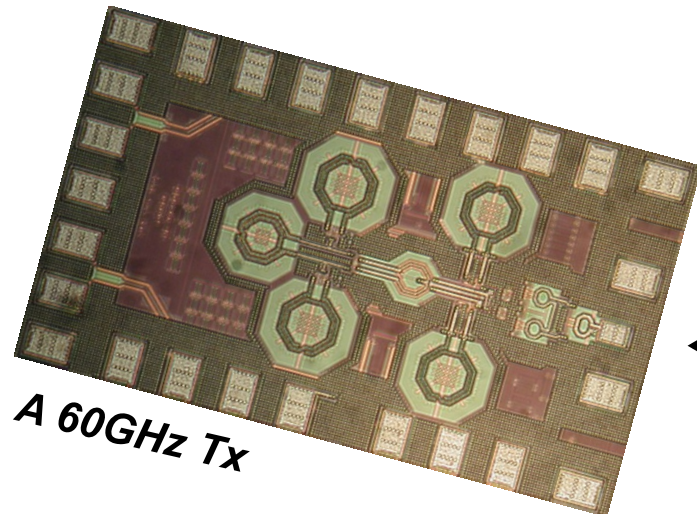


A 70 and 210GHz
LO generator

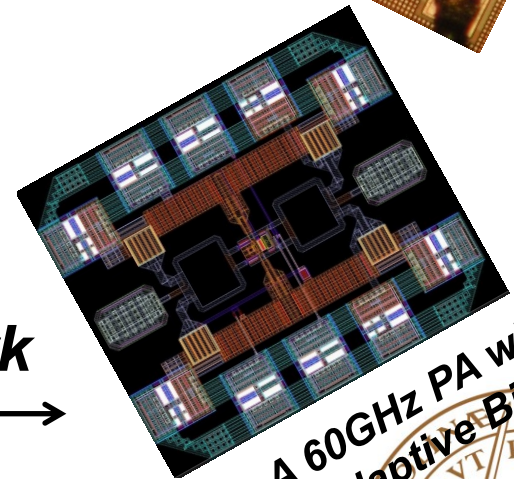
A 60GHz-Band PA



... ongoing work



A 60GHz Tx



A 60GHz PA with
Adaptive Bias



Andreas Axholt and Henrik Sjöland

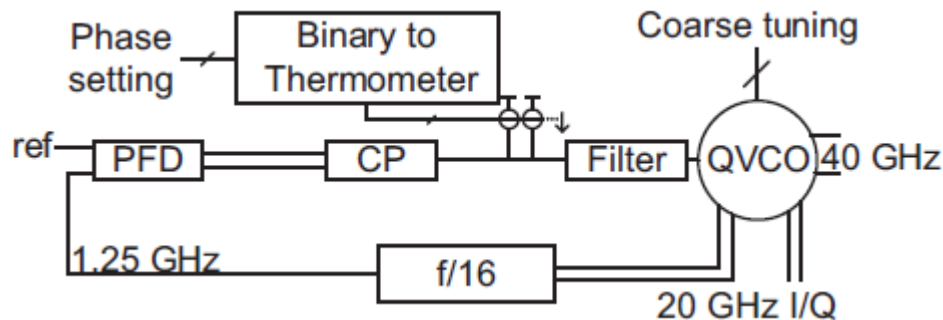
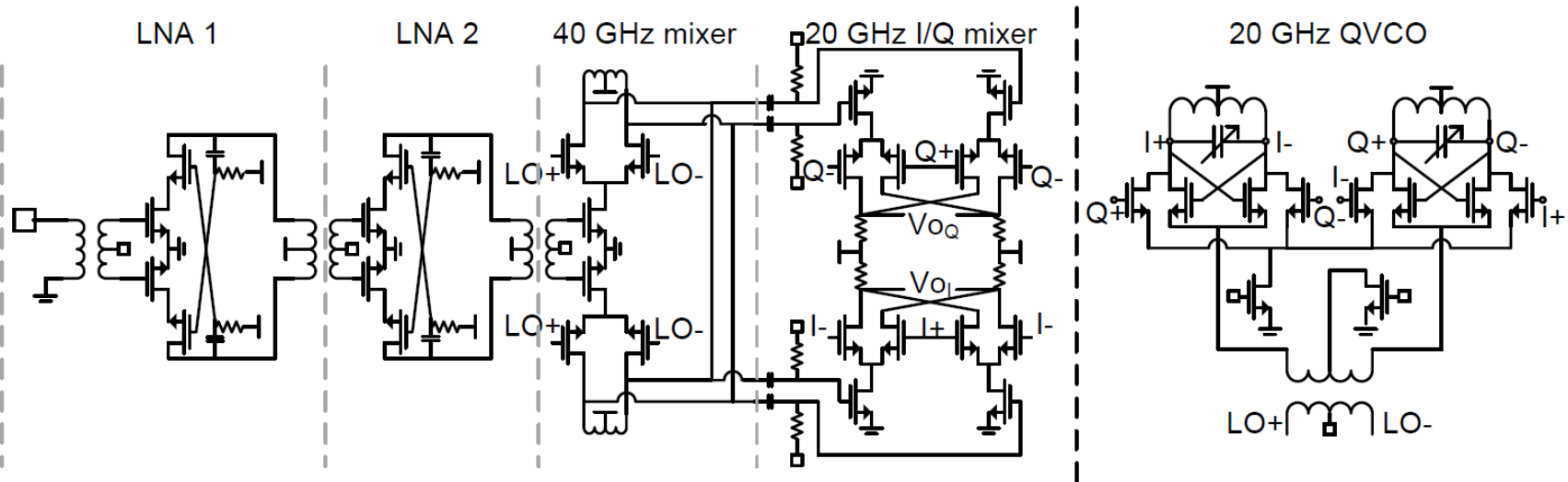
A 60GHz Receiver Front-End with PLL based Phase Controlled LO Generation for Phased-Arrays

APMC 2011, Melbourne

Markus Törmänen – EIT – Lund University



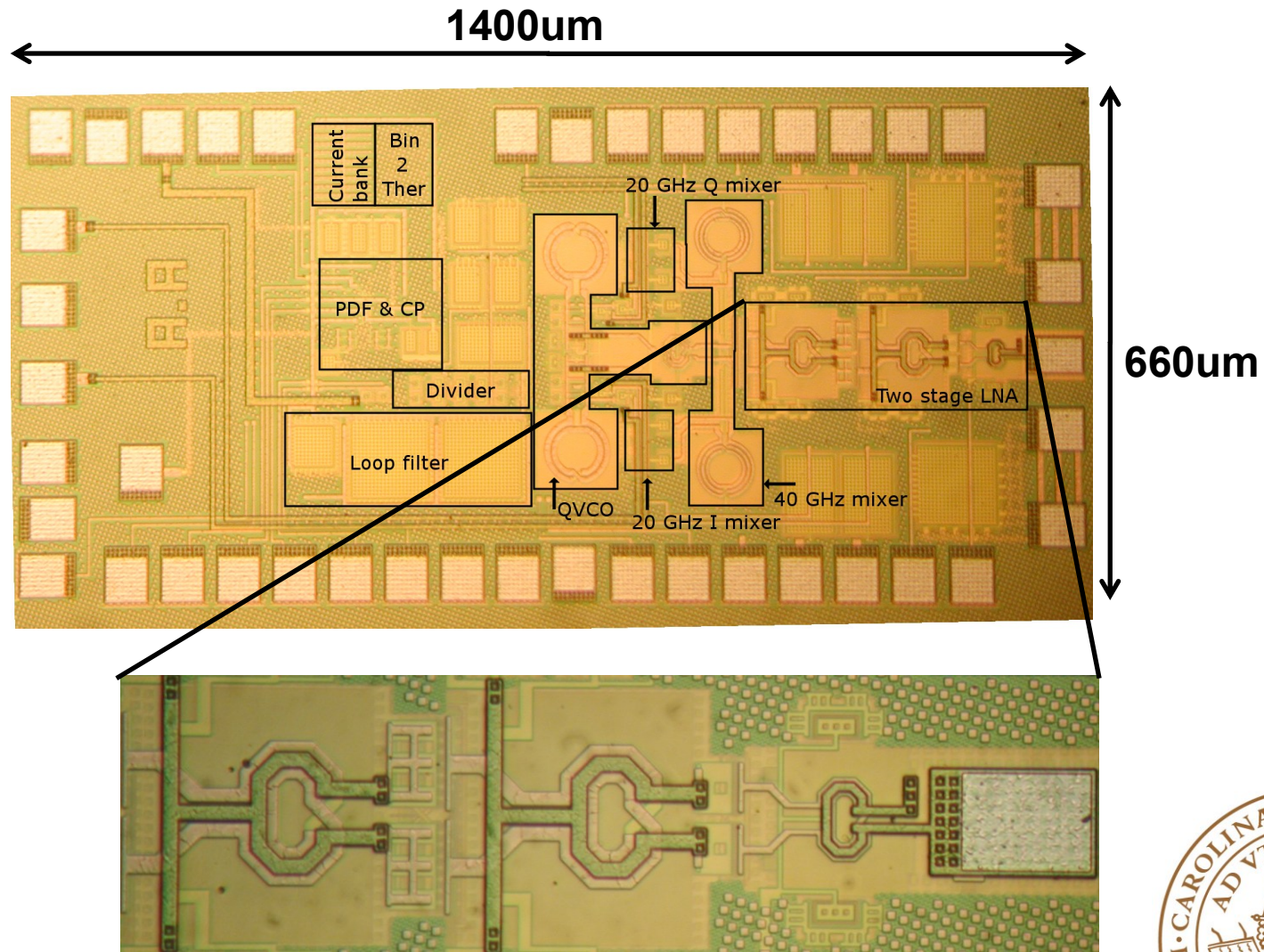
A 60GHz Receiver Front-End for Phased-Arrays



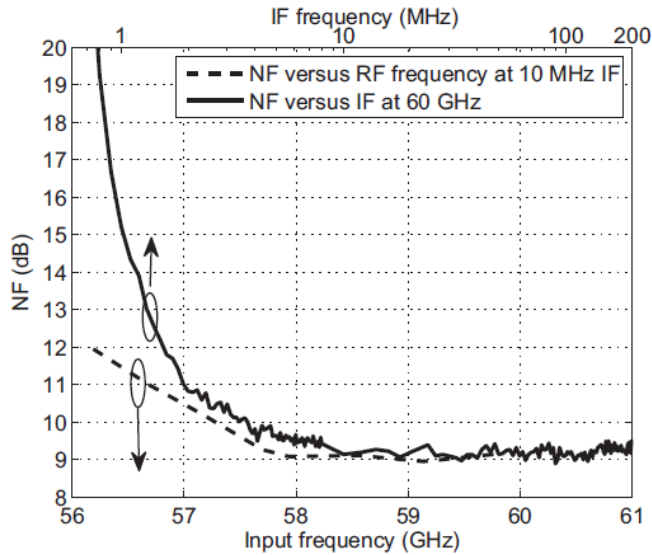
$$\Delta\varphi = 2\pi N \frac{I_{inj}}{I_{cp}}$$



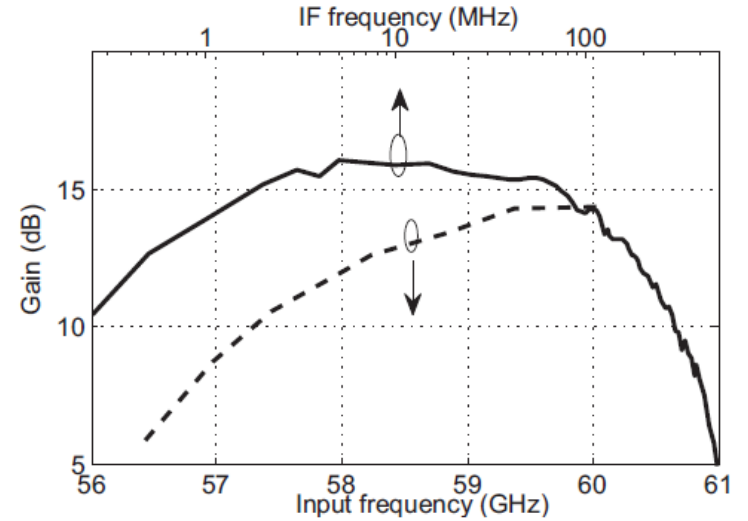
A 60GHz Receiver Front-End for Phased-Arrays



Noise figure

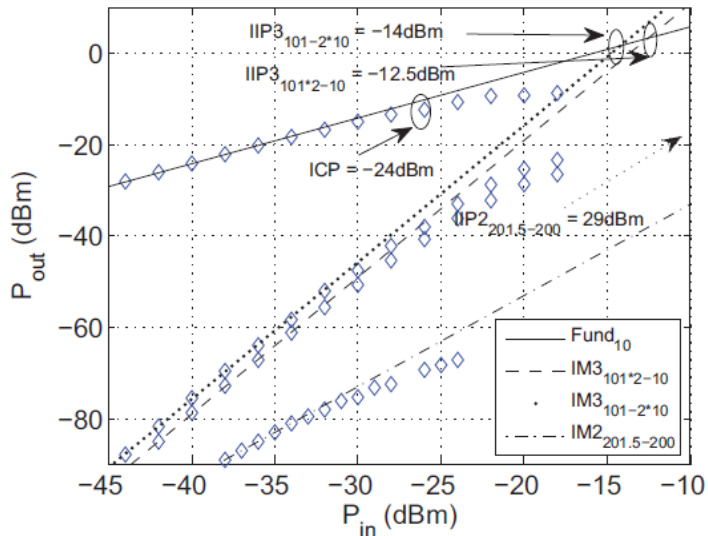


Gain

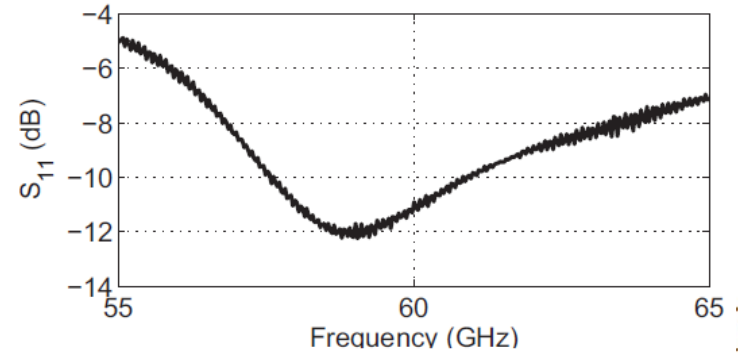


90nm CMOS
1.2V, 80mA

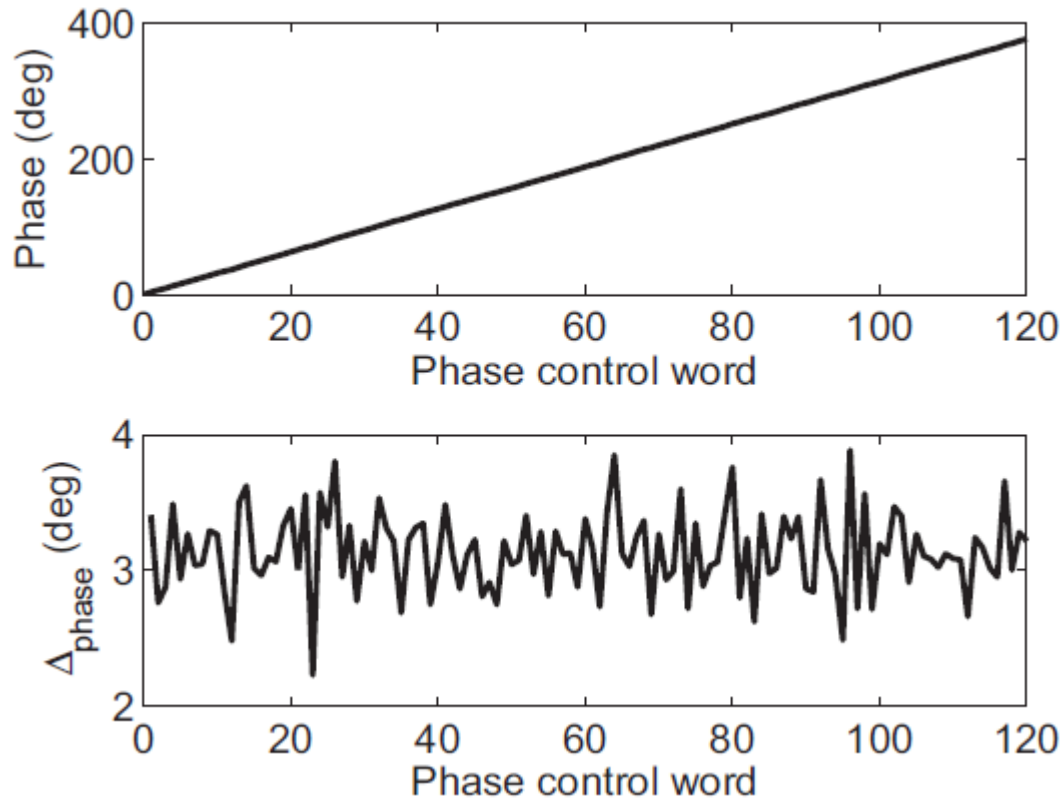
Linearity



Matching



A 60GHz Receiver Front-End for Phased-Arrays



Markus Törmänen, Jonas Lindstrand, and Henrik Sjöland

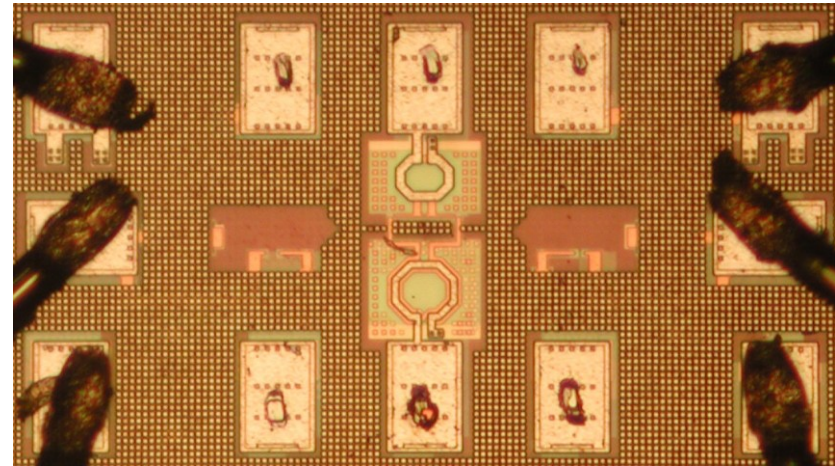
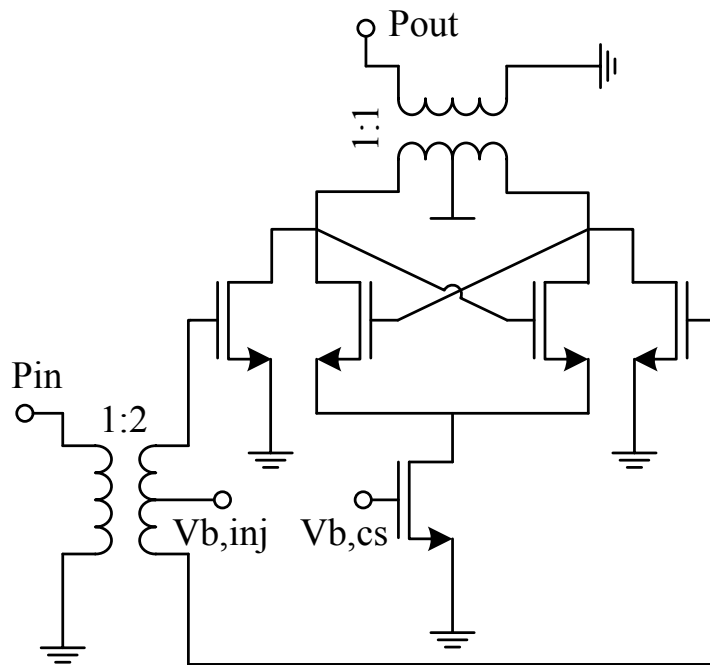
***A 13dBm 60GHz-Band Injection Locked
PA with 36% PAE in 65nm CMOS***

APMC 2011, Melbourne

Markus Törmänen – EIT – Lund University



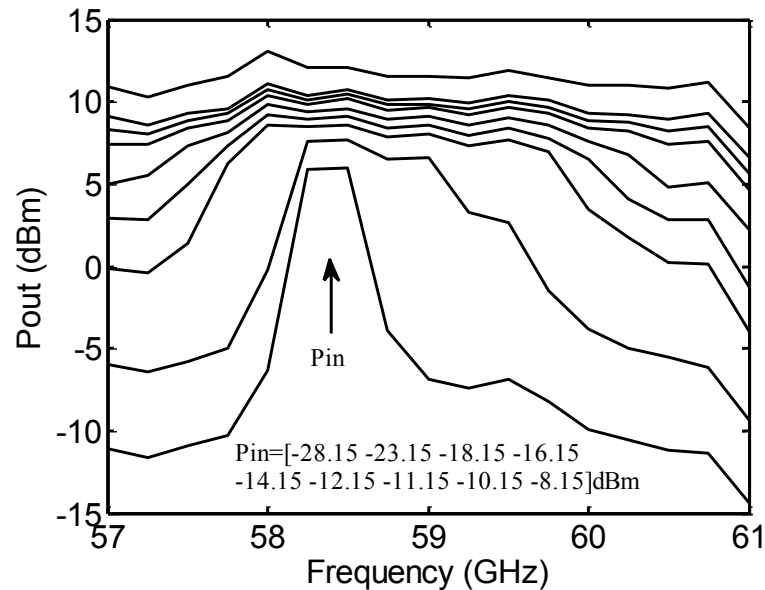
60GHz-Band Injection Locked PA in STM 65nm CMOS



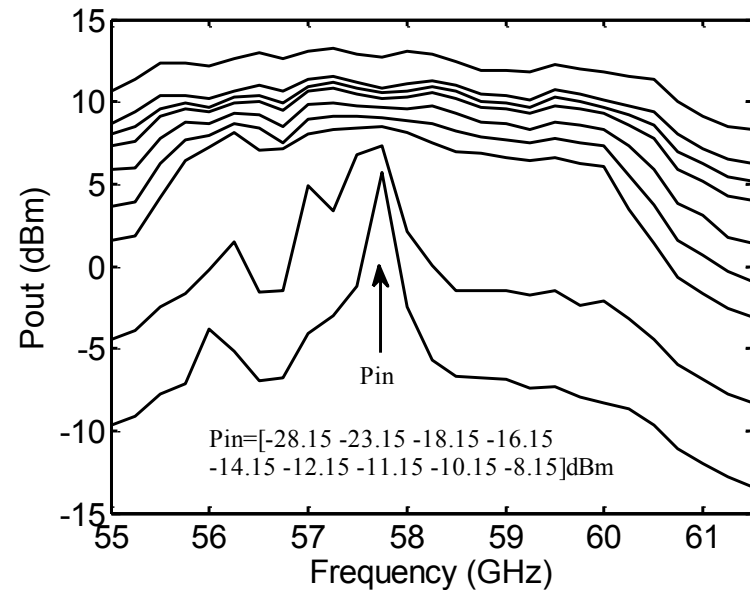
Chip: $0.54 \times 0.29 \text{ mm}^2$
Core: $0.08 \times 0.14 \text{ mm}^2$



60GHz-Band Injection Locked PA in STM 65nm CMOS



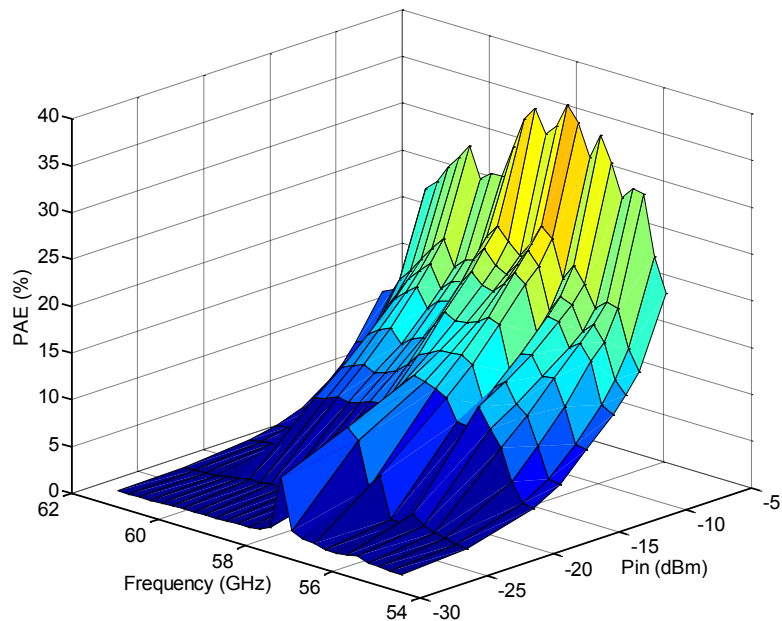
*Measured Pout
versus frequency
(swept increasingly)
for different Pin.*



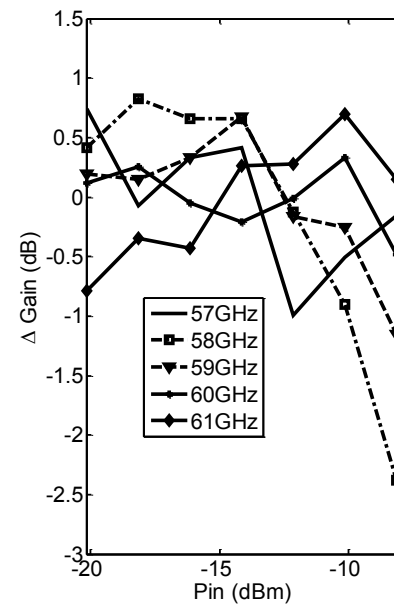
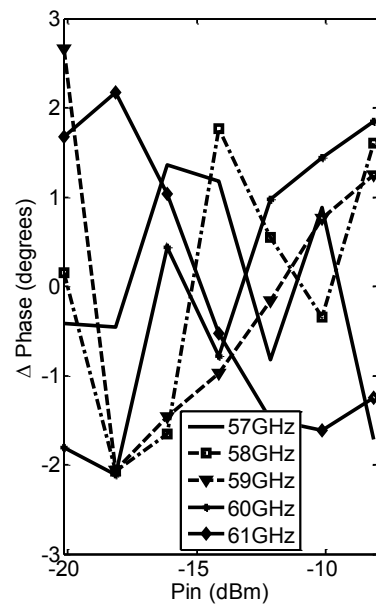
*Measured Pout
versus frequency
(swept decreasingly)
for different Pin.*



60GHz-Band Injection Locked PA in STM 65nm CMOS



54.8mW Pdc, 13dBm



42mW Pdc, 9.8dBm

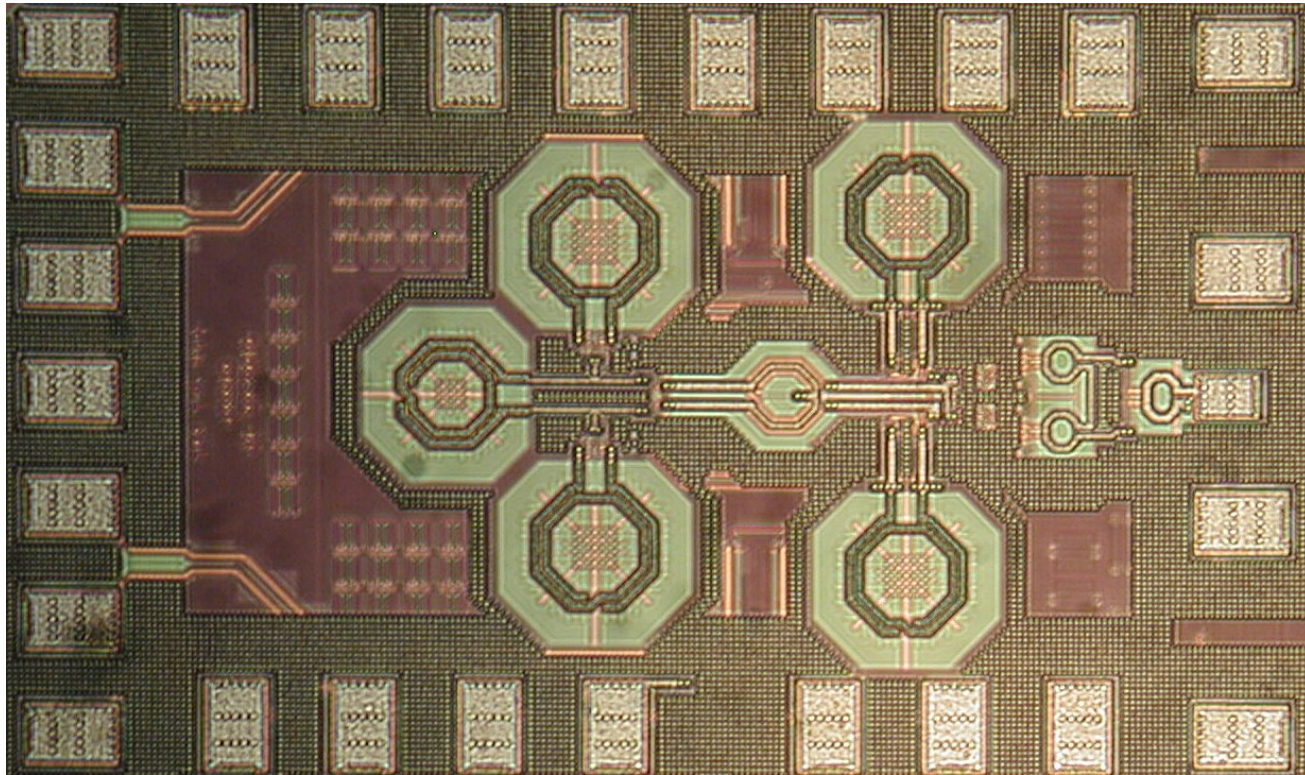


... and ongoing work



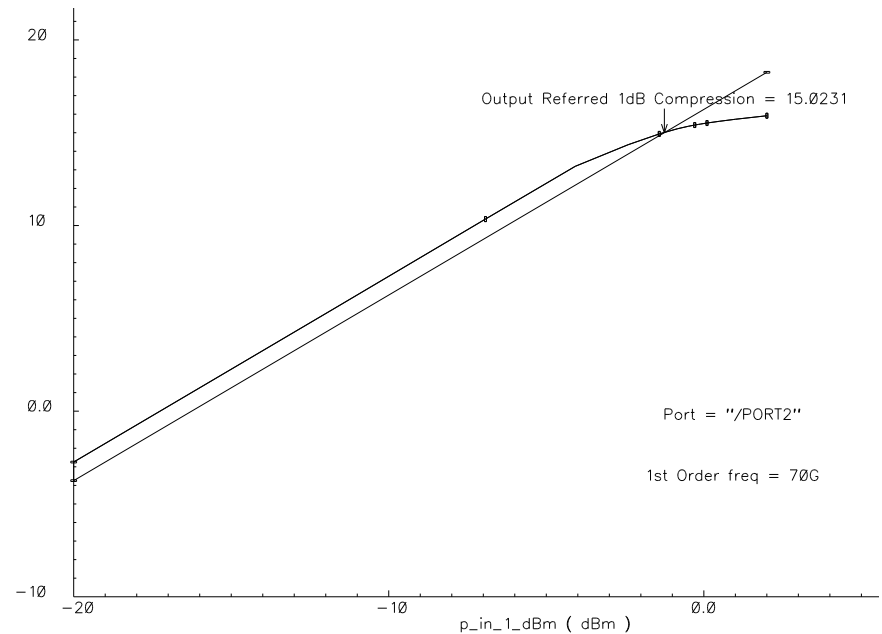
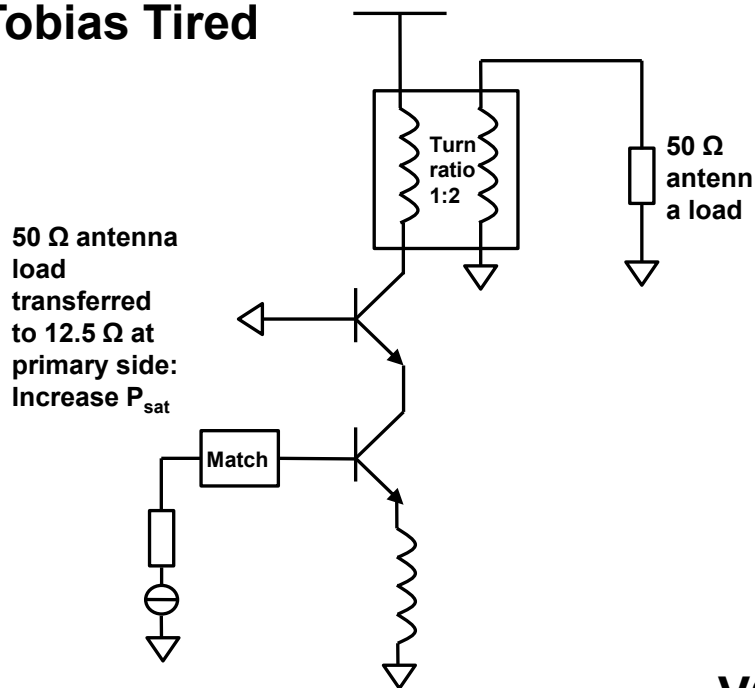
A 60 GHz Transmitter in STM 65nm CMOS

Markus Törmänen, Carl Bryant, Jonas Lindstrand



Beamsteering mm-wave links - SiGe BiCMOS

Tobias Tired



Single ended PA for E-band: 71-76, 81-86 and 92-95 GHz.
Simulations made at 70GHz.

$VCC = 2.5V$
 $OP_{1dB} = 15.0dBm$
 $P_{sat} = 15.9dBm$
Gain = 17.3dB
 $I_{DC} = 45mA$
Peak PAE = 35%

