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ISART 2017 PANEL: 5G/MM-WAVE CAPACITY IMPROVEMENTS: A SYSTEMS PERSPECTIVE

PROF. GREGORY D. DURGIN

SCHOOL OF ELECTRICAL AND COMPUTER ENGINEERING

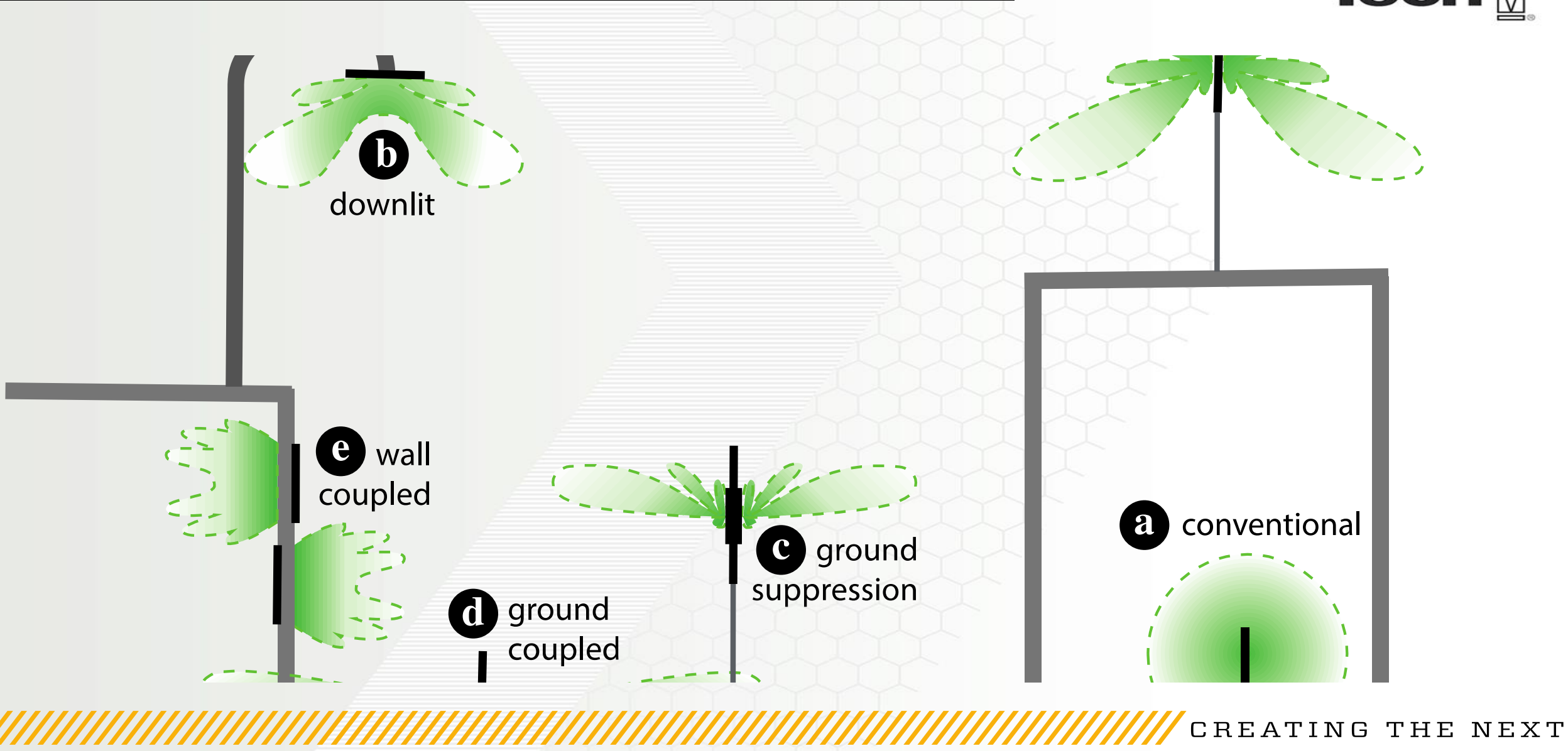PROPAGATION GROUP - WWW.PROPAGATION.GATECH.EDU

CREATING THE NEXT

Issues in Mining Spectrum for More Capacity

- Ultradensity Issues

- mm-Wave Power Consumption

- Mining for Services, not Bandwidth

- Most capacity gains come from frequency re-use, but...

- Smaller cells have trouble shrinking due to propagation.

- Boomerang effect: increasing density decreases overall capacity
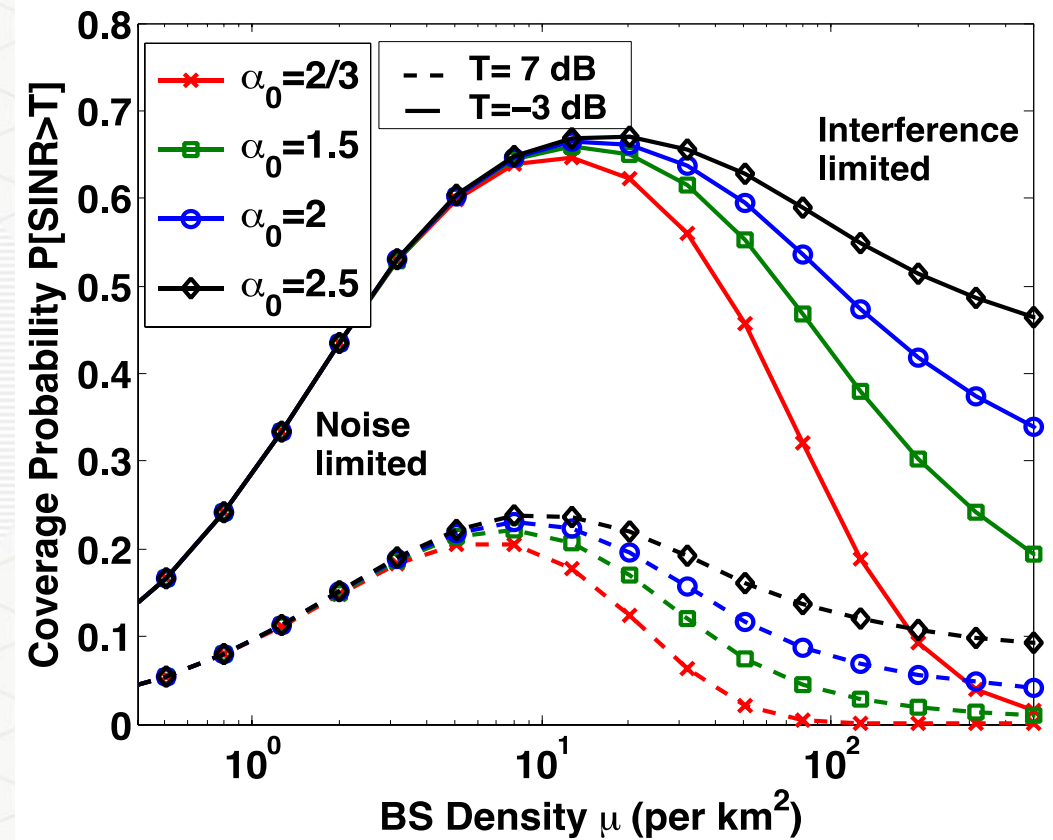
J.G. Andrews, **X. Zhang**, G.D. Durgin, **A.K. Gupta**. "Are We Approaching the Fundamental Limits of Wireless Network Densification?" accepted to *IEEE Communications Magazine*, 2016.

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b downlit

e wall coupled

d ground coupled

c ground suppression

a conventional

CREATING THE NEXT

mm-Wave Hardware...

- Lossy Electronics

- power amps and frequency synthesizers take a lot of power

RF Oscillator

Data Signal
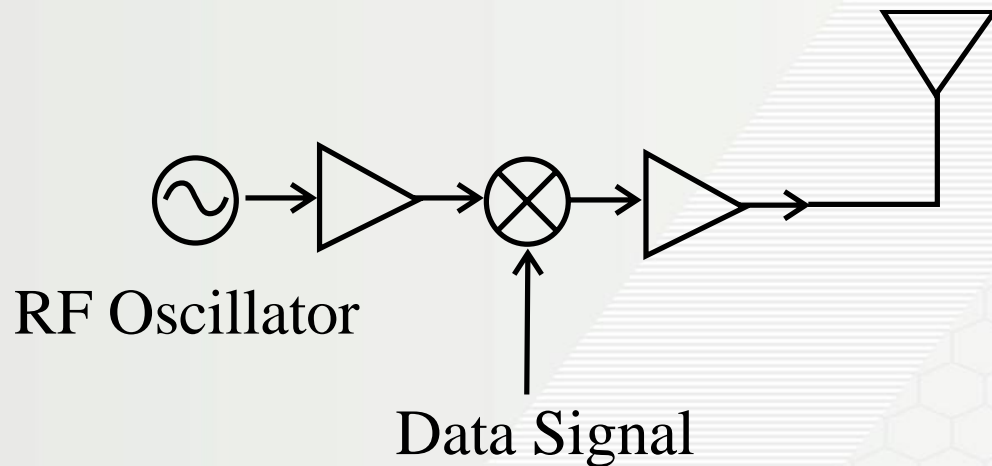
mm-Wave is power-hungry

but...

Can support high data rates

so...

bits/Joule approaches LTE

BUT...

Energy-limited user

buys same # of bits

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Quantum Tunnel Reflectors

1.2 km 5.8 GHz Backscatter Link @ 23 μW
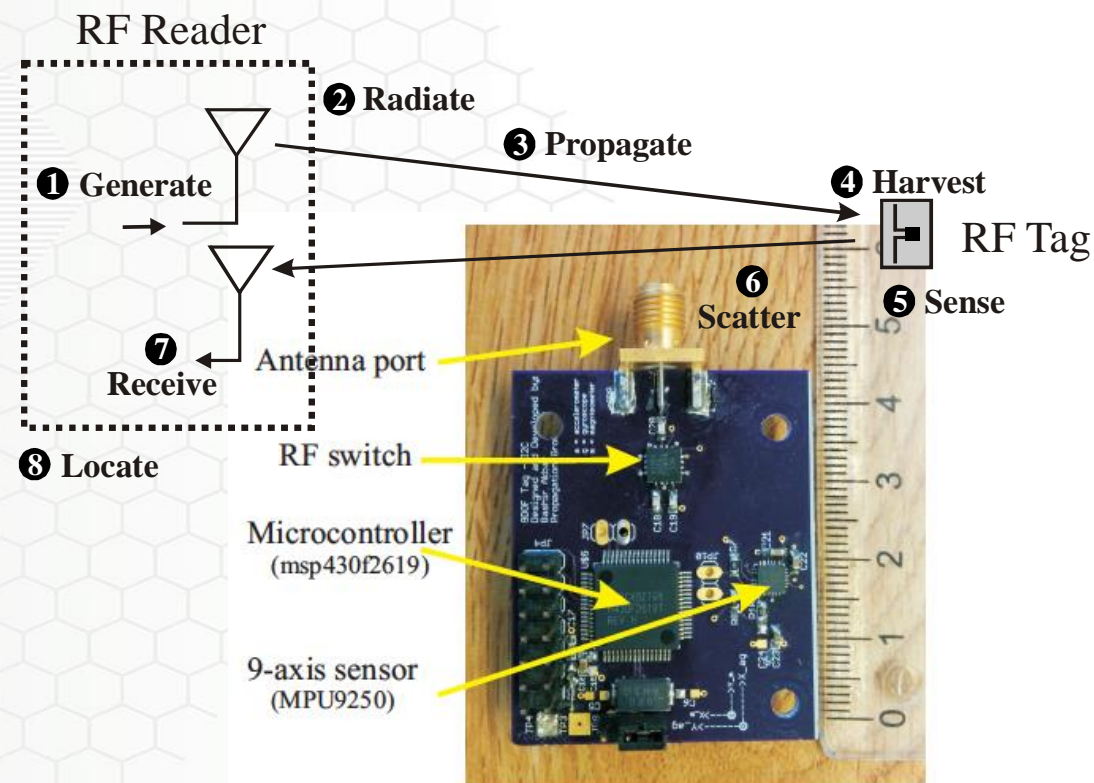

F. Amato, C.W. Peterson, B.P. Degnan, M.B. Akbar, G.D. Durgin. "Long Range and Low-Powered RFID tags with Tunnel Diode". *IEEE RFID-TA 2015*. Tokyo, Japan. 16-18 September 2015.
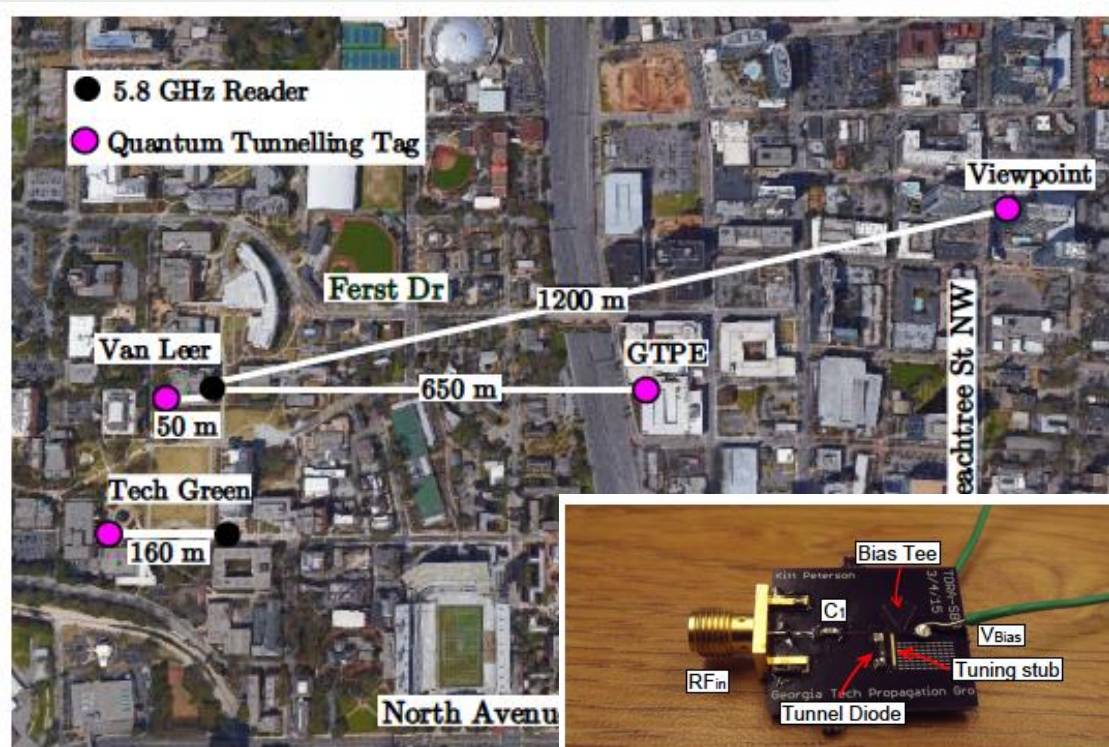
(a) Reflection Amplifier prototype

Hybrid Inertial Microwave Reflectometry

Localization with 1-2mm positioning error!

M. Bashir Akbar GT Dissertation 2016