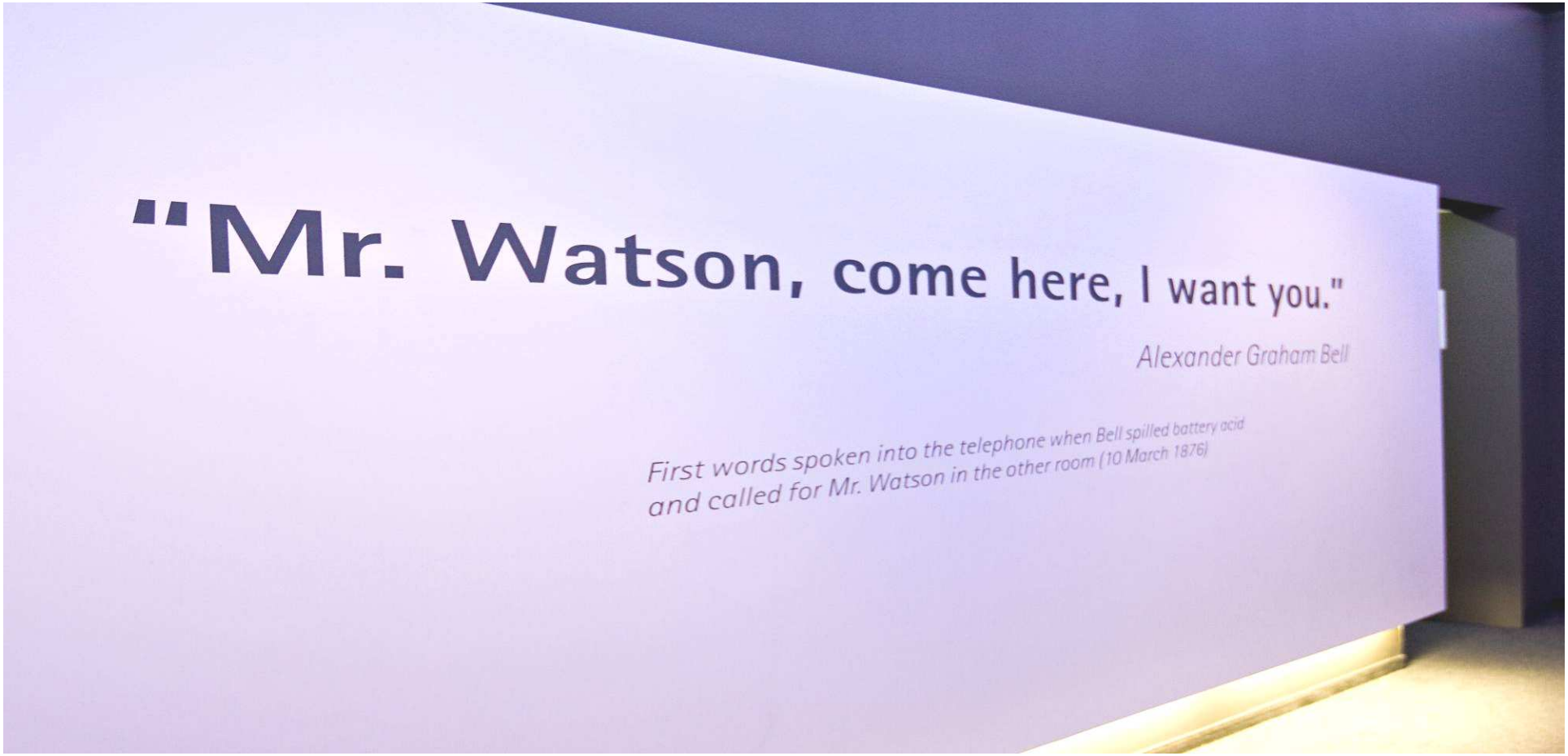

Infrastructure Perspectives on Receiver

Alcatel-Lucent Wireless Chief Technology Office

Stephen A. Wilkus

March 12, 2012

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Tower top

- A leading network integrator with 20,000 network experts providing professional services from design, manufacturing, deployment and operation of wireline and wireless networks throughout the world

#1 in CDMA*
#2 in LTE (16% ahead of 3rd)*
#1 in Ethernet Cell Site Gateways**
#2 in IP Edge & Core Routing**
#1 in Femtocells**


Macro Cells


Metro Cells


femto Cells

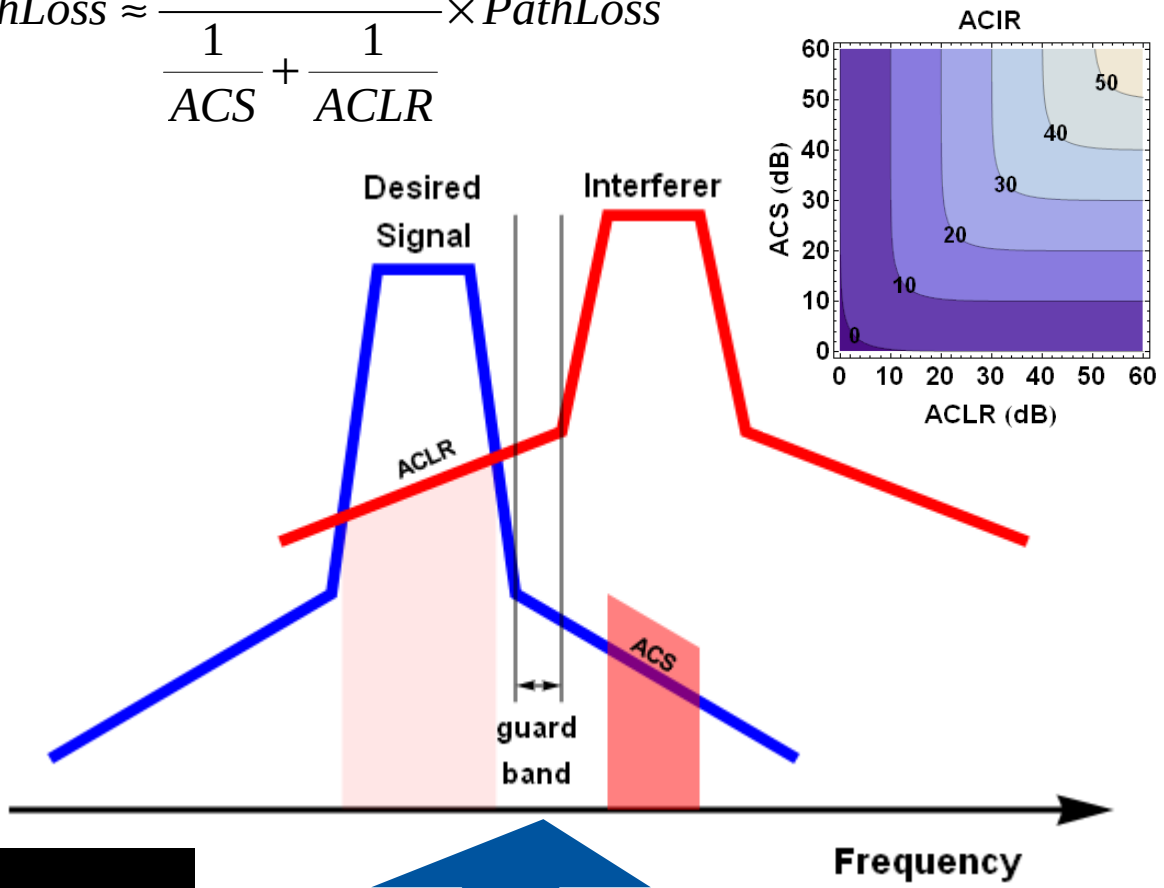
*according to Dell'Oro; **according to Infonetics

Receiver Performance and Interference Mitigation

$$ACIR\_P = ACIR \times PathLoss \approx \frac{1}{\frac{1}{ACS} + \frac{1}{ACLR}} \times PathLoss$$

The interference received is a combination of the receiver's selectivity and the interferer's leakage. The transmitter can only mitigate one component, the receiver the other.

The gap between the two frequency bands (guard band) and its depth effects the filter insertion loss, stop-band rejection, weight, size and expense.



Adjacent Channel Interference Ratio	ACIR	Effect
Adjacent Channel Selectivity ratio	ACS	Rec. Resp.
Adjacent Channel Leakage Ratio	ACLR	TX Resp.

Macrocell filters mitigate interference

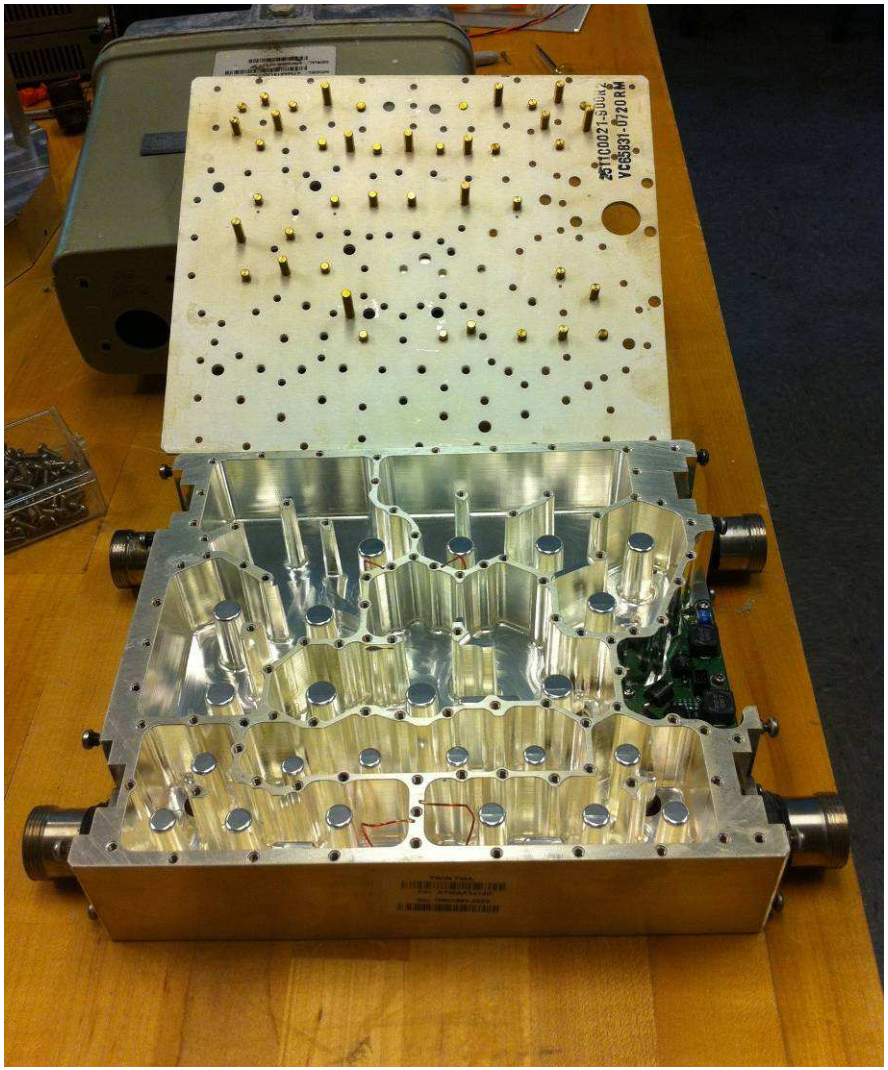
Macrocells with their high towers and large coverage areas transport tens of Watts of RF power, requiring robust RF filters, e.g. filters made from metal cavities, each about λ/4 in size.

These are heavy and bulky but extremely capable of providing extraordinary filtering with:

<5 MHz transition bandwidth and 40 to 50 dB rejection.

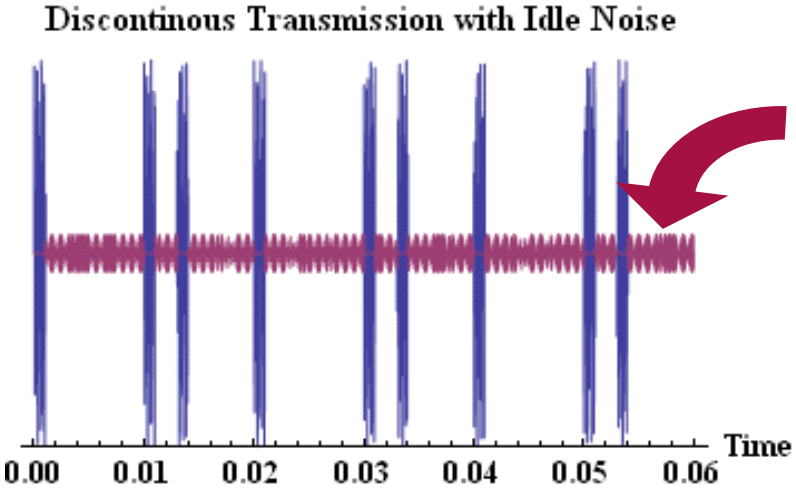
These work with IF and baseband filters to provide at least 85 dB of rejection… but at a cost.

But… Metrocells and femtocells have less room for such elaborate filters.



Summary

- Traditionally, Macrocellular base stations have afforded substantial filters to mitigate both received and transmitted interference (OOBE).
- Emerging Small Cells have a smaller budget for filter's size and weight
- Smaller cells are located closer to interfering equipment but are less sensitive
- Some receivers are more sensitive to the envelop of the interfering waveform
  - Discontinuous Time transmissions such as GSM and LTE often cause interference to AM receiver, hearing aides, speaker phones, stereos, RFIDs and DVB-T TV receivers, etc.
  - Adding "idle noise" or relaxing on-off ratios can reduce interference into such products.
  - In such cases, *adding interfering power can counter-intuitively improve victims reception*.



Idle noise added to empty time slots.

Adjacent Channel Selectivity Ratio	ACSR	Rec. Resp.
Discontinuous Transmission	DT	TX Resp.
Out Of Band Emissions	OOBE	TX Resp.

Stephen A. Wilkus

Steve Wilkus works in the Alcatel-Lucent Wireless Chief Technology Office as a Distinguished Member Technical Staff. He is a Senior member of the IEEE and a member of the Alcatel-Lucent Technical Academy. In his current role, he supports wireless operators in their use of spectrum and in their radio access network planning.

He joined Bell Laboratories Lucent Technologies (then part of AT&T), as a Researcher and Developer of Surface Acoustic Wave filters used in undersea cable and wireless products. His interest in wireless communications lead to work on IEEE 802.11 and other standards and regulatory work in the AT&T Chief Architect's Office.

In 1991, he spearheaded the development of a wireless electronic shelf label system sold through NCR using RFID technology. He later led the first team to demonstrate High Speed Packet Access (HSPA) in 2003 and was the solutions architect for the fist satellite/terrestrial hybrid DVB-SH system.

Steve received the B.S. degree in physics and the M.S.E.E. degree from the University of Illinois, Urbana, in 1981.

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