FCC Workshop on 3.5 GHz

ASA, Small Cells, LTE

March 2013

QUALCOMM®

Authorized Shared Access

A New Way Of Licensing Mobile Broadband-Spectrum

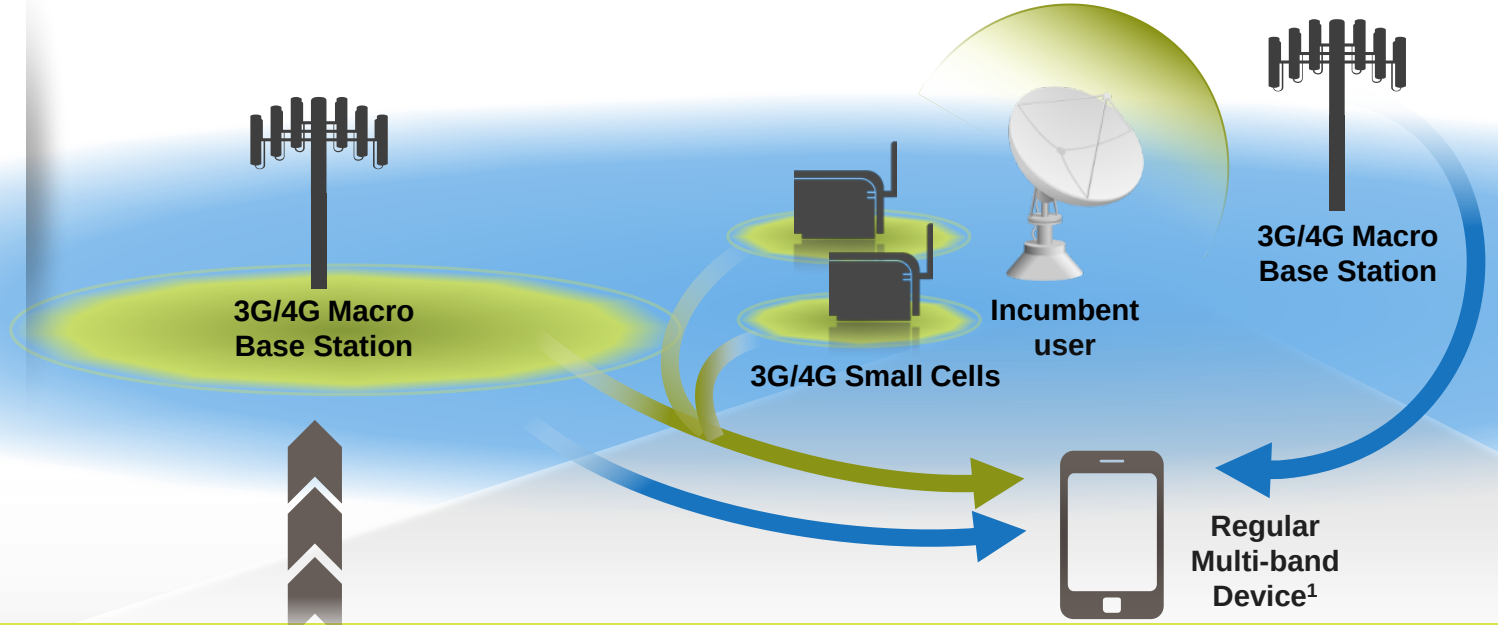
Harmonization and Global Standards Drive Economies of Scale

* a current holder of spectrum rights of use which have not been granted through an award procedure (first come, first served; beauty contest, auction) for commercial use

ASA Takes Advantage of Existing Mobile Technologies and 3GPP Standards

COST-EFFECTIVE

- Use available 3G/4G infrastructure
- Complements installed 3G/4G
- Leverage existing 3GPP standards



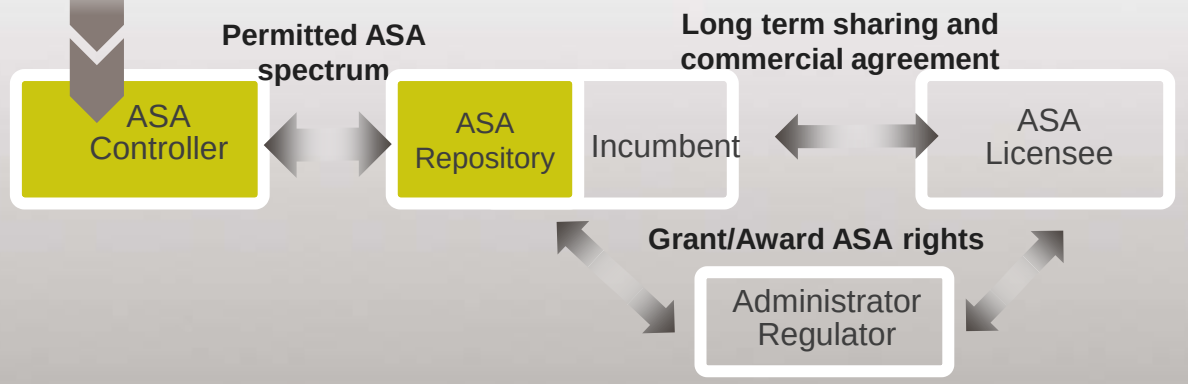
Regular Multi-Band Device[1]

- Opportunity to aggregate wider spectrum

Network controls device spectrum access[2]

SIMPLE & VOLUNTARY

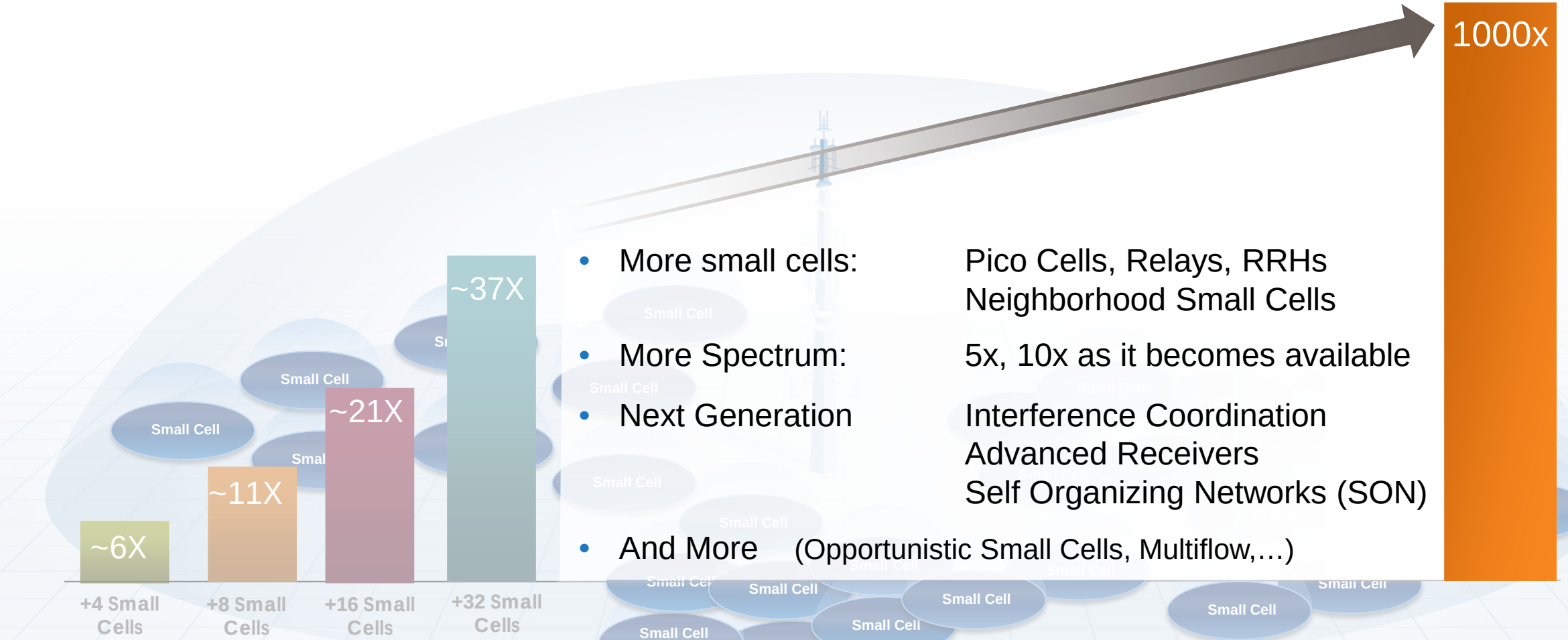
- Simple technology with defined interfaces
- Regulatory framework
- No device impact



CONTROLED

- Enables predictable quality of service
- Protects incumbent from interference

[1]No device impact due to ASA, just a regular 3G/4G device supporting global harmonized bands targeted for ASA. Carrier aggregation would be beneficial to aggregate new ASA spectrum with existing spectrum, but is not required.
[2]The O&M system of the ASA rights holder enforces the permitted bands



- More small cells: Pico Cells, Relays, RRHs
  Neighborhood Small Cells
- More Spectrum: 5x, 10x as it becomes available
- Next Generation: Interference Coordination
  Advanced Receivers
  Self Organizing Networks (SON)
- And More (Opportunistic Small Cells, Multiflow,…)

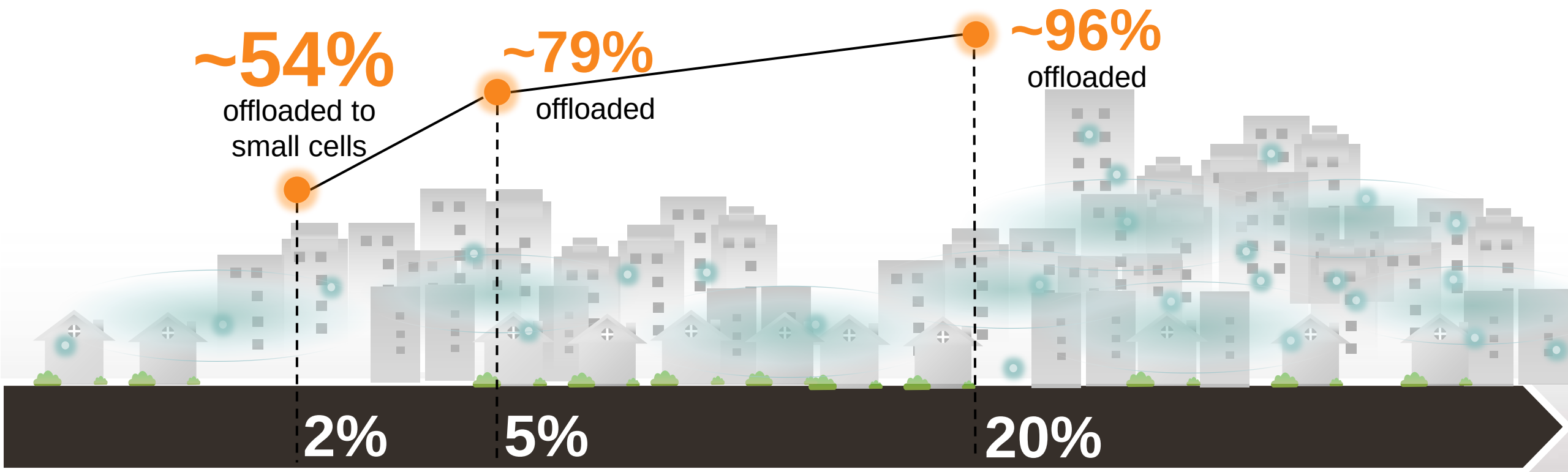
Capacity scales with small cells added[1]

LTE Advanced with 2x Spectrum added

The Roadmap To 1000x with Cellular Technology: More Small Cells, More Spectrum and Improved Techniques

[1]Assumptions: Pico type of small cell, 10MHz@2GHz + 10MHz@3.6GHz,D1 scenario macro 500m ISD, uniform user distribution scenario. Gain is median throughput improvement, from baseline with macro only on 10MHz@2GH, part of gain is addition of 10MHz spectrum. Users uniformly distributed—a hotspot scenario could provide higher gains. Macro and outdoor small cells sharing spectrum (co-channel)

LTE – Neighborhood Small Cells
Even Low Small Cell Penetration Provides Good Performance



Household Penetration, Neighborhood Small Cells

- Low Transmit Power Sufficient[1]
- Gain not sensitive to external wall loss

Example for LTE FDD, 2x2 MIMO. Assumptions: 70% indoor users, 200 Active users per macrocell, small cells randomly dropped in households in a mix of 2 to 6 story apartments Macro uses 2GHz and small cells uses 3.5GHz. Shows the percentage of users offloaded to the small cells [1]Interference limited, not coverage limited; 20mW or less is sufficient (we compared 20mW/13 dBm with a baseline of 100mW/20dBm).