Flexible Spectrum for Flexible Spectrum Management

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ComReg Test License Scheme

CTVR BANDS

Transmit Areas

2.08 GHz

2.35 GHz

25 MHz

25 MHz
smart networks await smart spectrum
overlay: opportunistic use

market-based spectrum assignment

underlay: easement use
radio spectrum rights continuum

- + 4 years
- + 1 year
- + 6 months
- now

- Galway
- Dublin
- Limerick
- Cork
current markets

GSM

WiMAX
emerging markets
varying granularity of assignment aggregations
.....complete disaggregation of market-based assignments
......or complete failure?
the wisdom of crowds
No Predefined Boundaries
spatial rights

geographical or spatial unit

the equator

the prime meridian

y - latitude

x - longitude

2°N, 1°W

0°, 1°W

2°N, 0°

0°, 0°
planning spatial requirements

antenna
- **variables**: power, polarization pattern, height

terrain
- **variables**: the entire topography can vary over all space
  (information available from USGS etc.)
planning spatial requirements

espatial grid
variables: population, significant economic areas
(data available from USGS etc)

economic target service area
planning spatial requirements

propagation modeling

variables: model (worst case, best case)
planning spatial requirements
planning spatial requirements

required package

ideal package
Radio frequency (Hz)

- Band begins at $X$ Hz
- Band ends at $Z$ Hz ($Z > X$)

Frequency rights
Band begins at 87 MHz
Band ends at 108 MHz (Z>X)

Dumb

Accessing frequency rights

Radio Intelligence Spectrum

Average
multi-band/
multi-mode

Band begins at X Hz
Band ends at Z Hz (Z>X)

Smart

Any Mode, Any Band
idealism
v.
realism
x marks the problem spot - interference
setting the boundaries – an ideal mask
spilling over the boundaries
smart solutions?
where to spend the $, ¥, €

- acquire excessive rights for dumb technologies

- acquire *just enough* rights with smart sensing and sculpting technologies

- acquire spectrum rights *elsewhere* with technologies that make spectrum fungible
a market for spectrum ‘blocks’
proposed 2007 ofcom auction
(2.6 GHz spectrum award)
proposed 2007 ofcom auction
(2.6 GHz spectrum award)
no prescribed centre frequencies and bandwidths - market defined

Bidder N

Bidder 3

Bidder 2

Bidder 1

in collaboration with ICES at Mason
start-up corporation
service area expands
service area expands
service area expands
same-site demand increases
more growth
competition
substitutability constraints
substitutability constraints
possible outcome
regulatory uncertainty

Comment of (then) FCC Commissioner Harold W. Furchtgott-Roth on Secondary Trading:

"The solutions to this problem, I believe, lie in three areas:

- We must make clear our rules, on the exclusionary and permissive authority to use spectrum rights.
- We must make clear our liability rules for interference, interference that is ..., interference on background and ambient noise, and;
- We must make clear the license transfer rules. They must be simple, transparent, and nondiscriminatory.

Until we do these things, until we make the bundle of rights that exist with spectrum, clear and predictable, less a pig in a poke and more a bundle of rights that can be traded in markets throughout America, we will not have solved the problem of secondary markets for spectrum."
Multi-party Experimental Trials of Dynamic Spectrum Access – 12 additional experimental licenses

- **Technical Significance**: intent is to illustrate advances in dynamic spectrum access technologies.

- **Demonstration of DSA Maturity**: demonstrations will be mature enough “to leave the lab.”

- **Demonstration of Competition, Coordination and Co-operation**: The extent to which the demonstration can coexist with other potential demonstrations on a coordinated or competitive basis

- **Concurrent Collection, Analysis and Dissemination of Spectral Activity**