Policy Implications of Propagation Analyses

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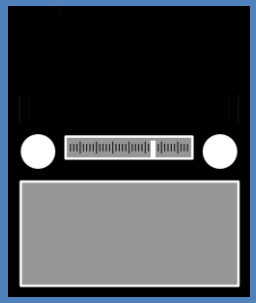
Note: The views expressed in this presentation are those of the author and may not necessarily represent the views of the Federal Communications Commission

What is Propagation?

A

For a signal emitted
at point “A”

B



What is the
predicted signal level
at point “B”?

Sounds Simple –
But “Things” Get in the Way

Terrain

Buildings

Atmosphere & Rain

Foliage

People

Propagation: Terms of Art

Propagation is Statistical

Models

- Free space/Line of Sight
- Irregular Terrain Model (ITM) (Longley-Rice)
- E-Hata/Okumura
- High Frequency
- Millimeter–wave
- IF-77 EM Wave
- Etc.

Choosing the Right Model

- Frequency dependent
- Nature of the service:
  - Mobile
  - Fixed
  - Satellite
  - Broadcasting
- Tx & Rx location
- Tx power
- Antenna heights
- Etc.

A Survey of Wireless Path Loss Prediction and Coverage Mapping Methods, by Phillips, C.; Sicker, D.; Grunwald, D.:

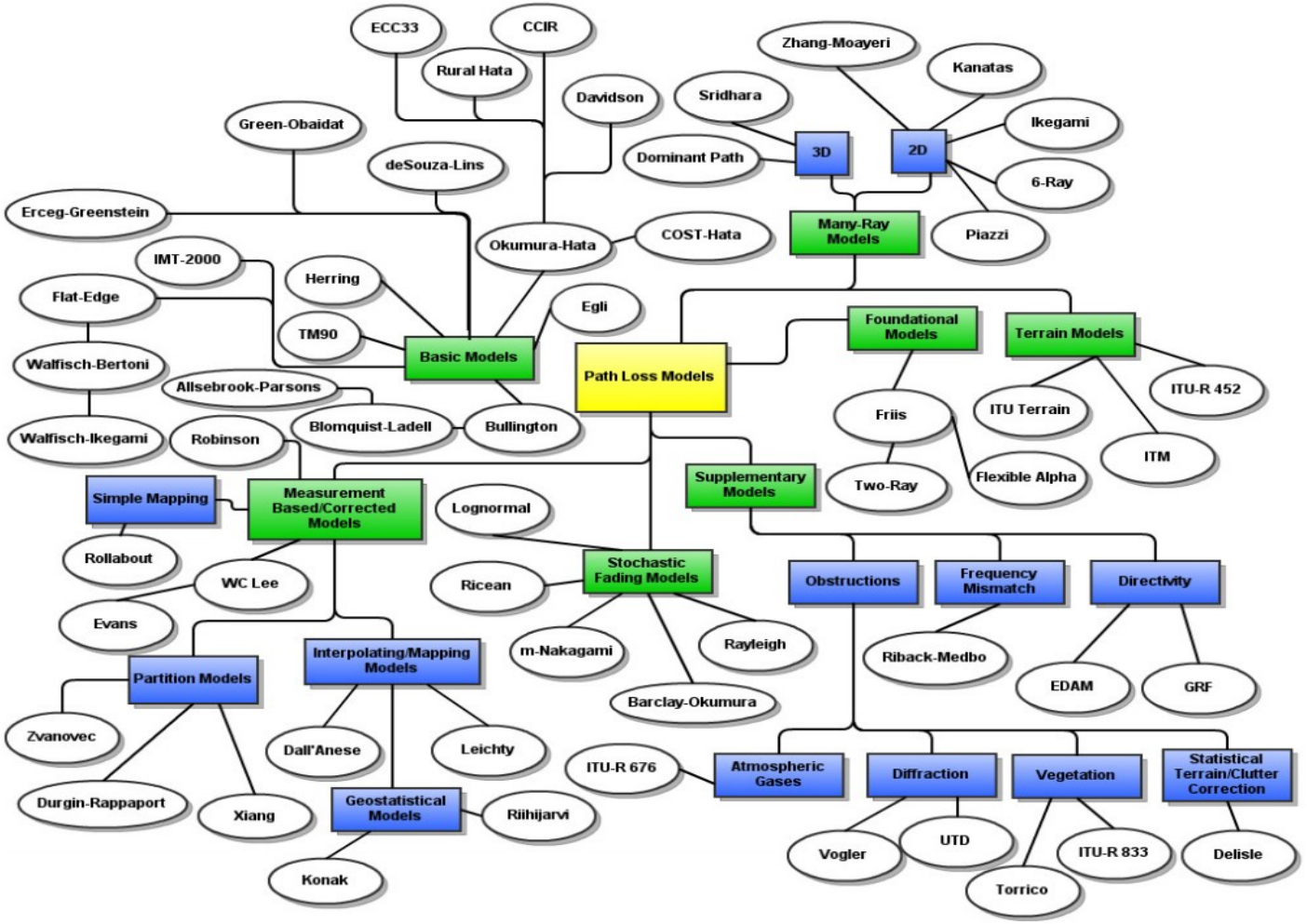
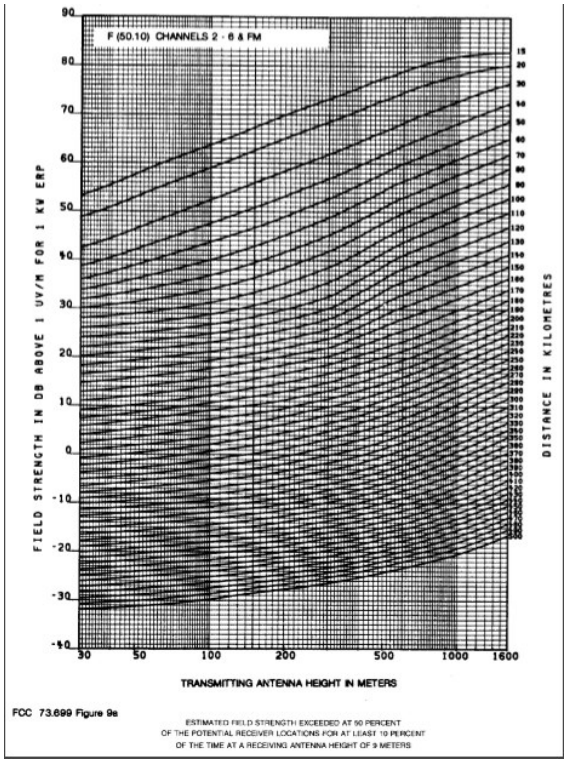


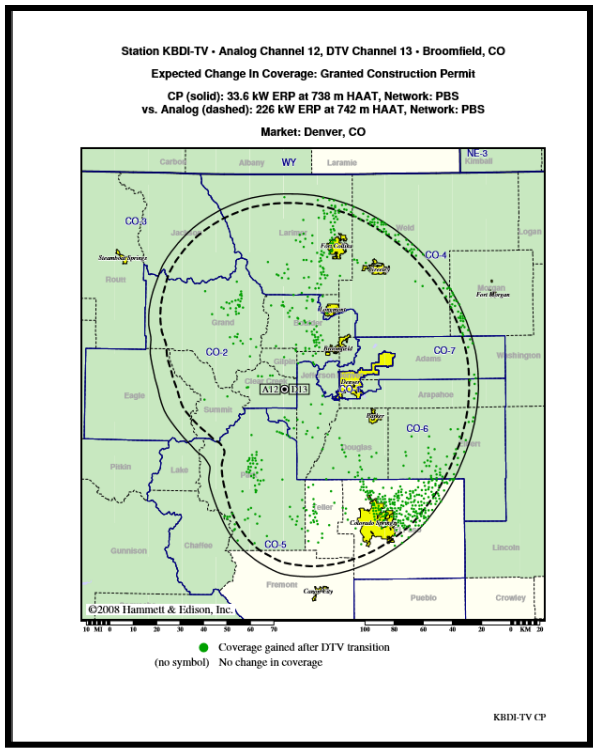
Fig. 1. Path loss model family tree. Individual models are shown as circles and categories as are shown as rectangles. Major categories are green. Minor categories are blue.

Role of Propagation: Predicting Coverage

DTV Transition: ***"Your Results May Vary"***

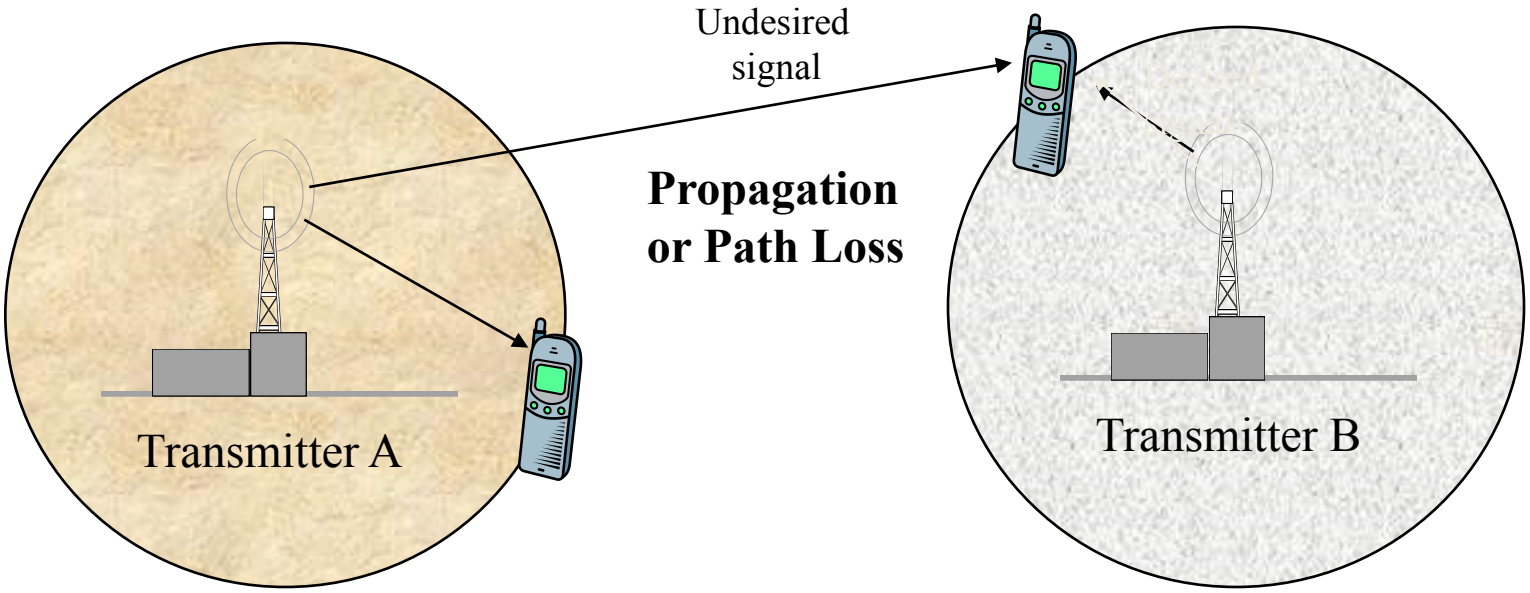


FCC TV Field Intensity Prediction Curves



FCC Predicted TV Coverage

Role of Propagation: Interference Analysis



The predicted propagation loss (along with other factors) affects the required separation distance . . . . Or whether two services can reasonably share spectrum

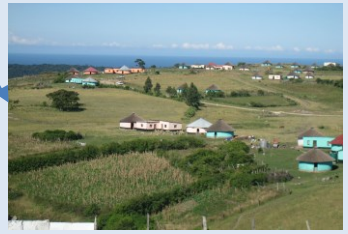
Implications for Policy Makers

- What assumptions to make about coverage:
  - 90% availability 50% of the time?
  - 99% availability 90% of the time?
  - **Affects quality/reliability of service**

- What assumptions to make about interference:
  - Free space/line of sight (worst case)?
  - Risk that interference may occur some places/time?
  - **Affects potential for others to access/share spectrum**

How Might We Do Better? Two Ideas

Dynamic Spectrum Access



Spectrum Access System

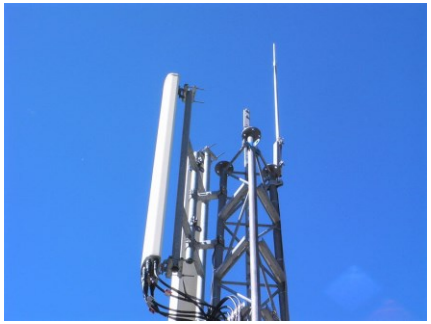
i.e. Citizen's Broadband Radio Service

"Paint" Actual Path Loss By Collecting Levels From Devices

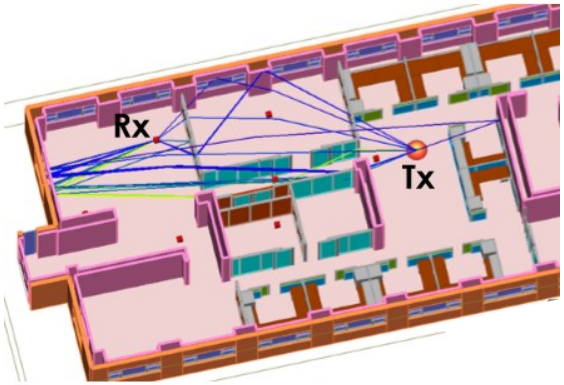
Improved Models

Maps
+
Building Characteristics

Propagation Implications for Millimeter Wave Spectrum (5G)



- Cell Size
- Number of cells for coverage
- Coverage into buildings
- Infrastructure challenges
- Affects costs
- Business case



Source: Phil Vigneron's presentation at ISART 2017

- Indoor coverage
- Number of access points that are needed

Thank You!