9th AECS Meeting,
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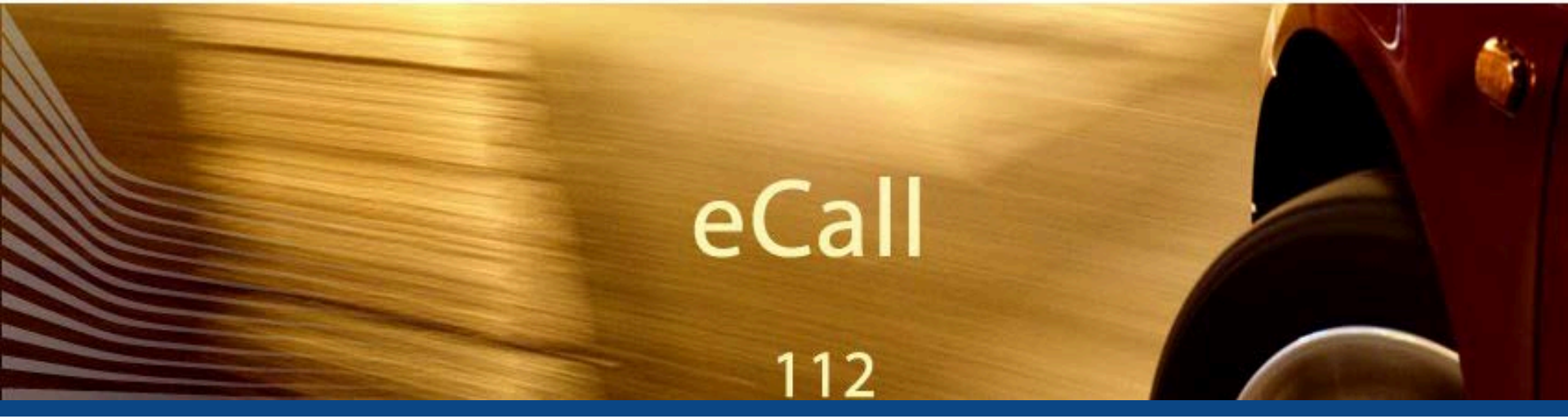


eCall RF Aspects

Ralf Weber

Outline

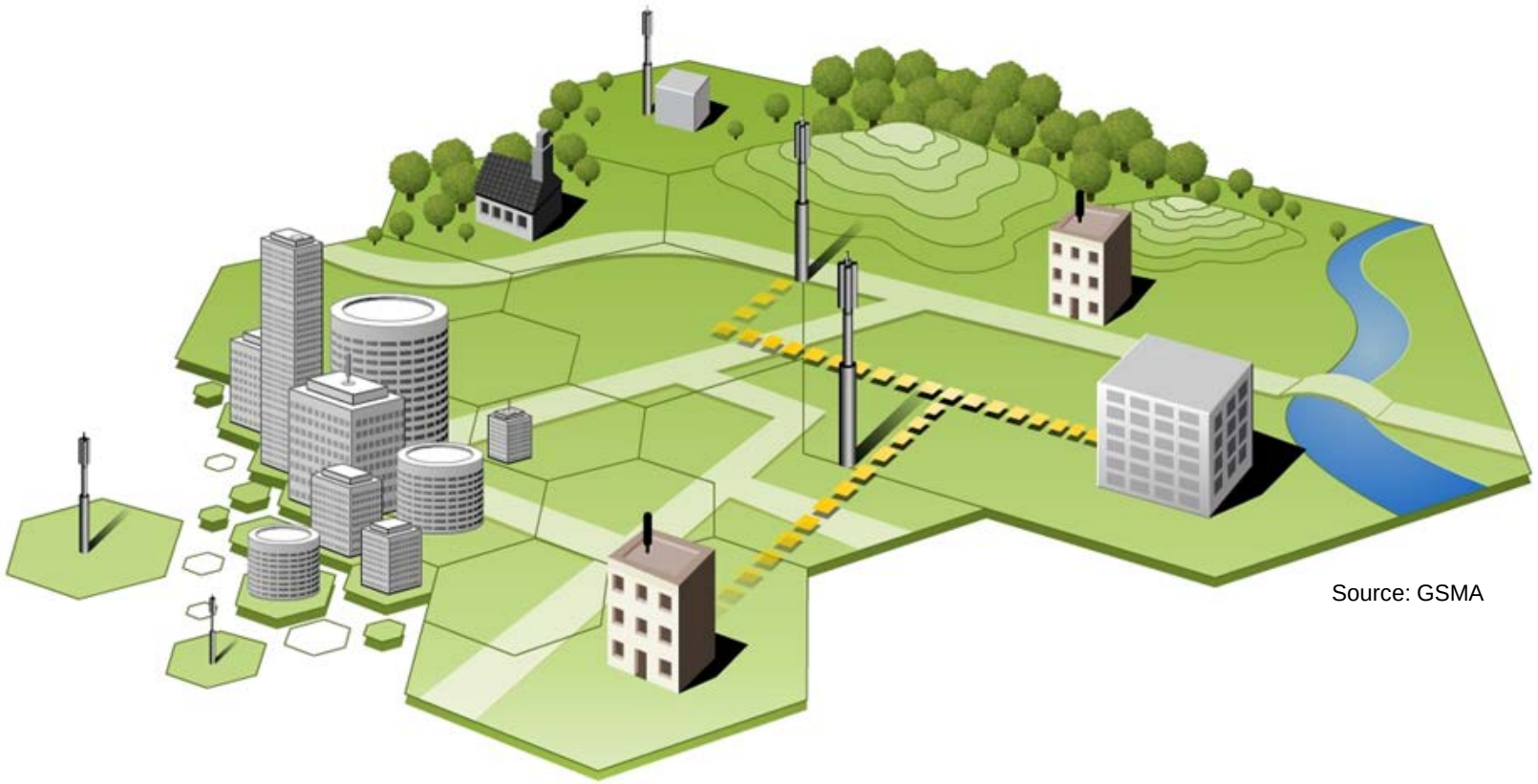
- Introduction
- Cellular network concept
- Network coverage examples
- MSD performance in weak coverage
- Impact of in-car propagation loss
- Conclusions

Introduction

eCall – Save Lives in an Emergency

- Goal
  - eCall should allow emergency organizations for faster response times by providing automatic and manual calls in case of an incident
- Typical use case
  - Car crash in rural or urban outdoor environments
- eCall requires mobile network coverage for TS12 emergency services
  - Voice services have the most reliable performance in todays networks
  - Call prioritization of TS12 emergency services are guaranteed by networks operators
- Caveat
  - Network operators have to provide emergency services only in regions where they have network coverage
  - Network coverage is a design criteria determined by commercial considerations and regulatory requirements
  - Network availability highly depends on type and placement of antenna systems

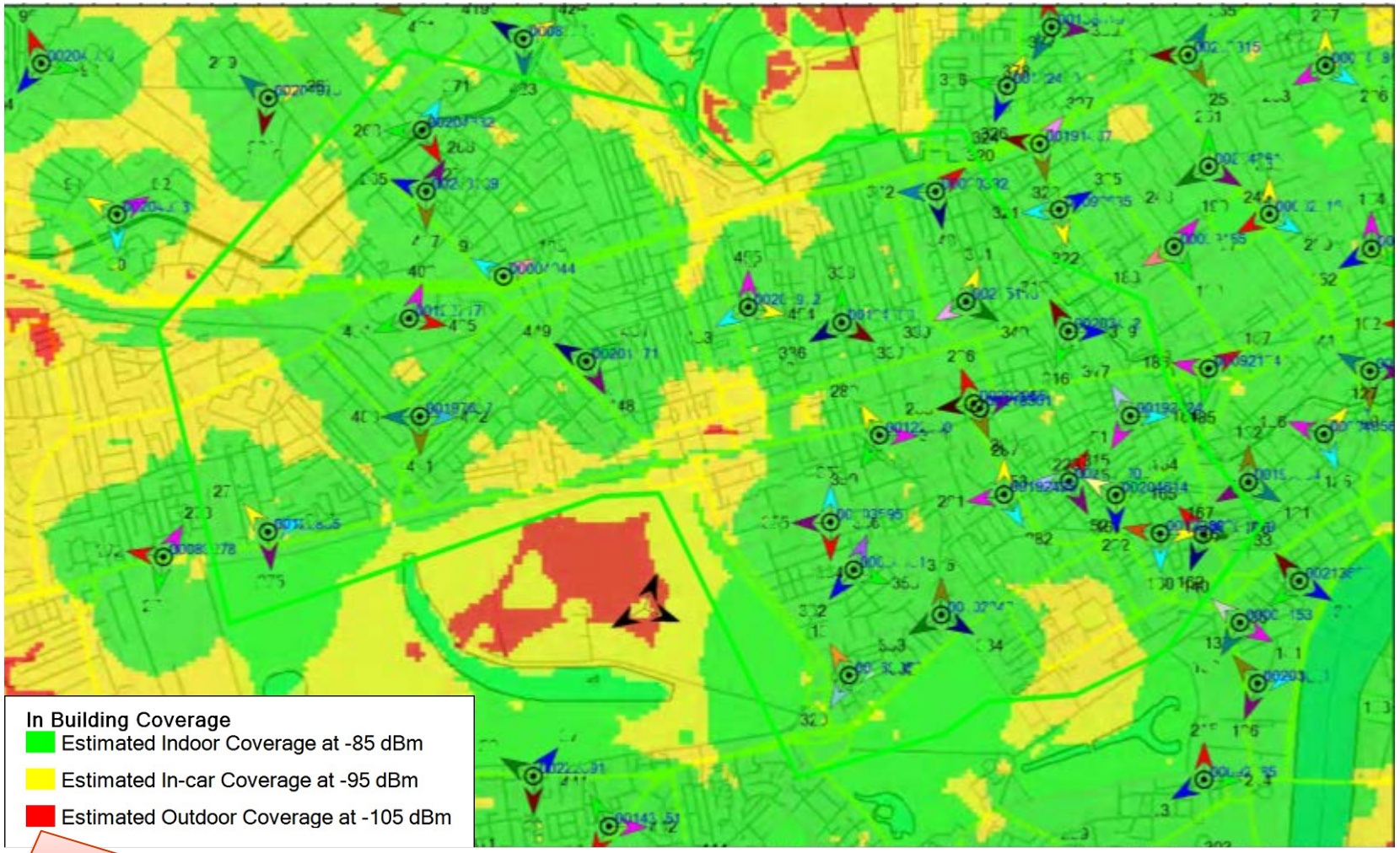
Cellular Network Concept



Source: GSMA

- A network consists of base stations covering limited areas (cells)
- Coverage continuity is achieved by partially overlapping cells
- Devices determine best suited cells based on receive power measurements

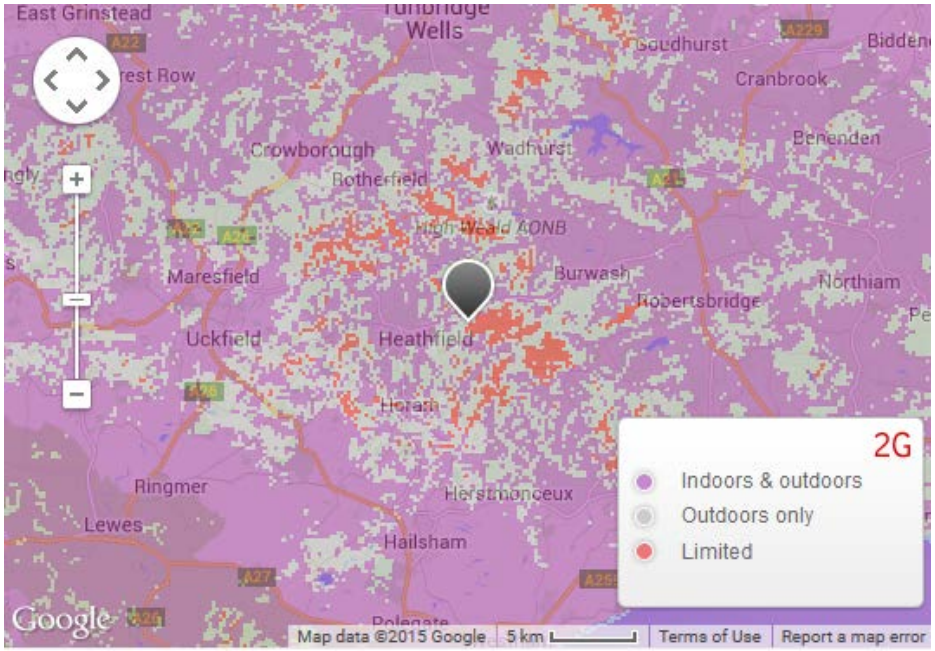
Coverage Example – Urban Area

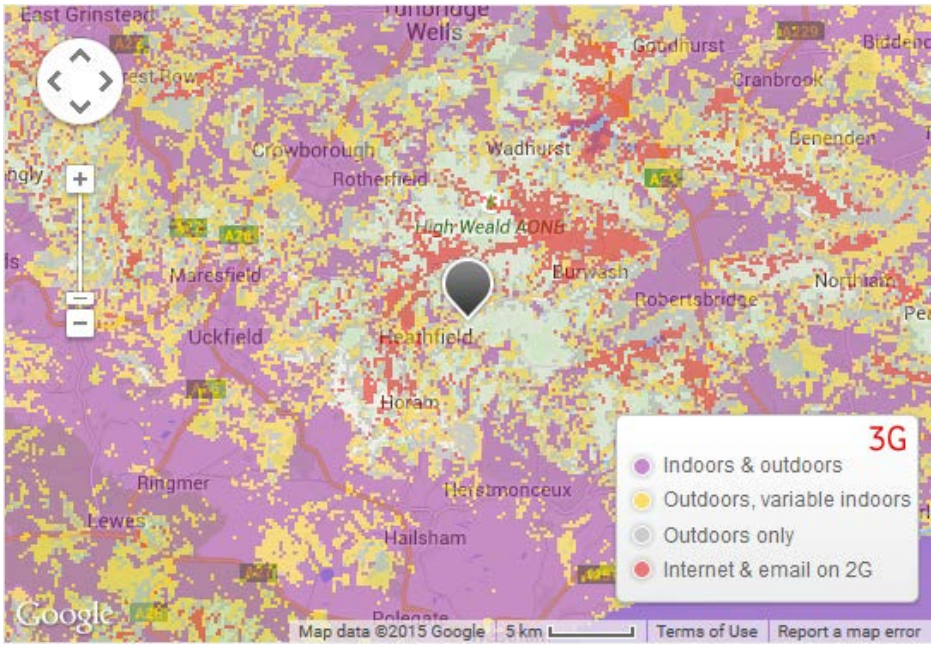


Areas of weak or no 112 service

Coverage Example – Rural Area

Example taken from https://www.vodafone.co.uk/explore/network/uk-coverage-map/index.htm





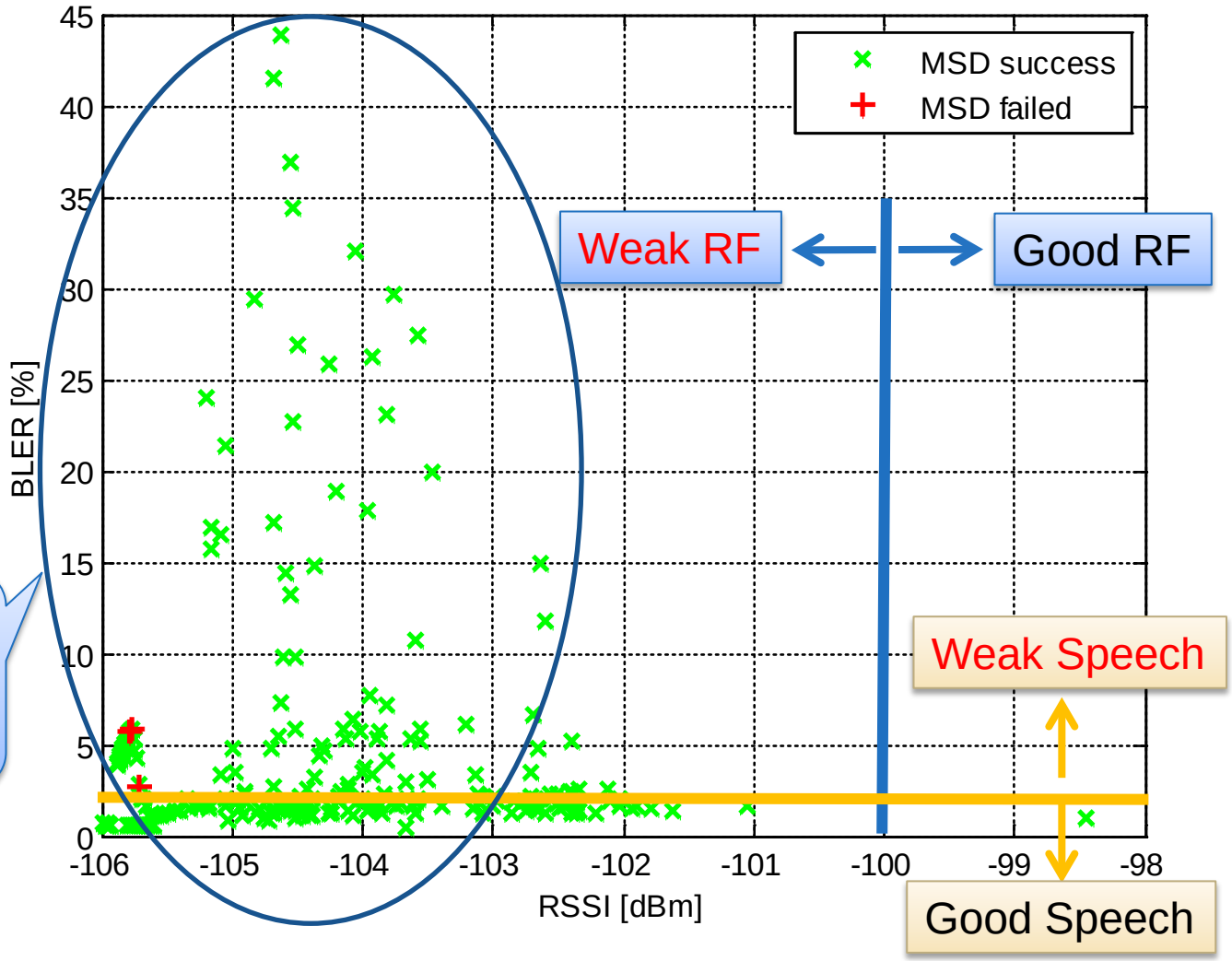
Regions of outdoor-only coverage can span several km

Expected IVS Performance

Weak Coverage Environment

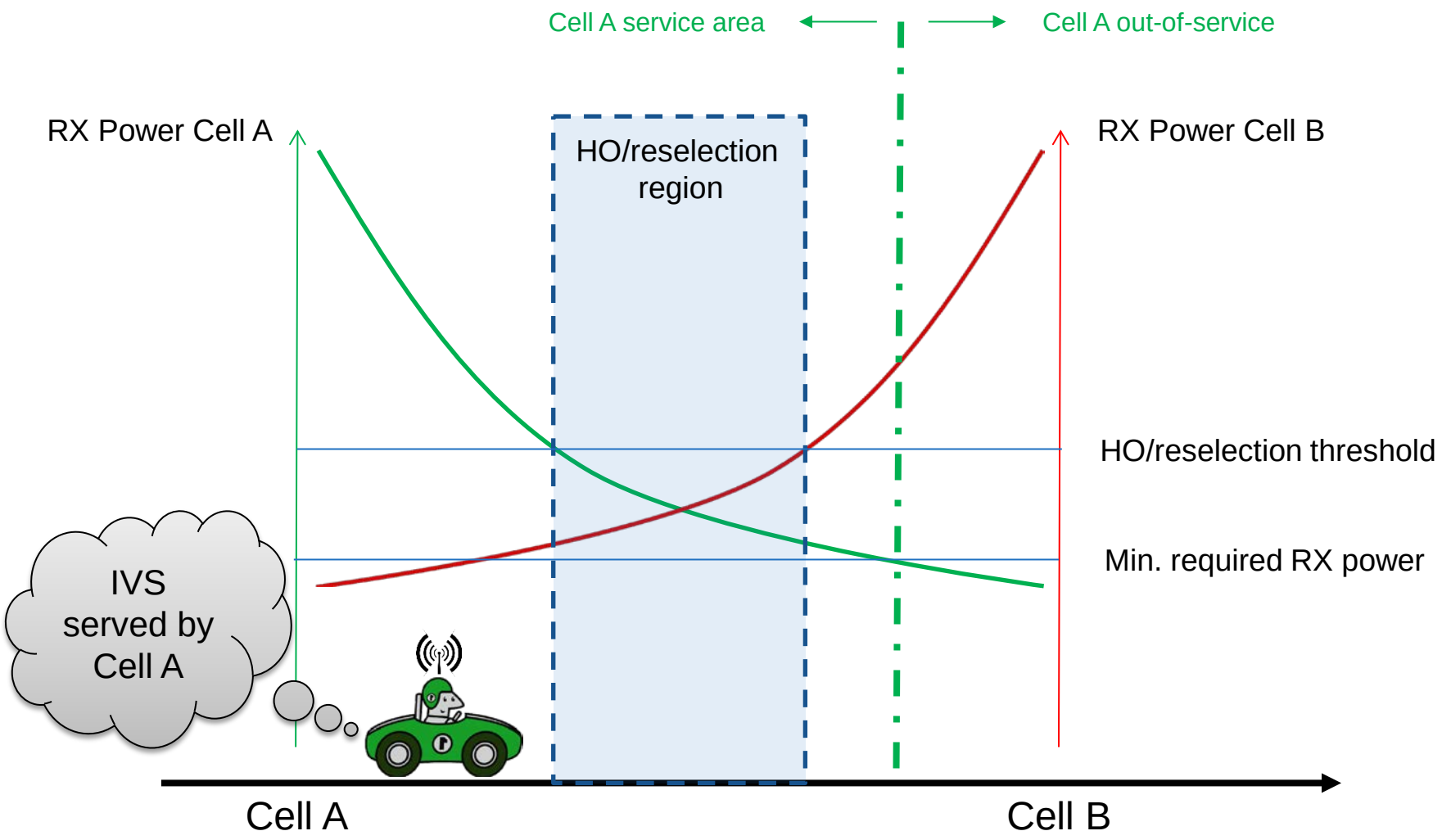
Measured MSD failures after successful call setup

Small number of MSD failures at low RSSI + high BLER



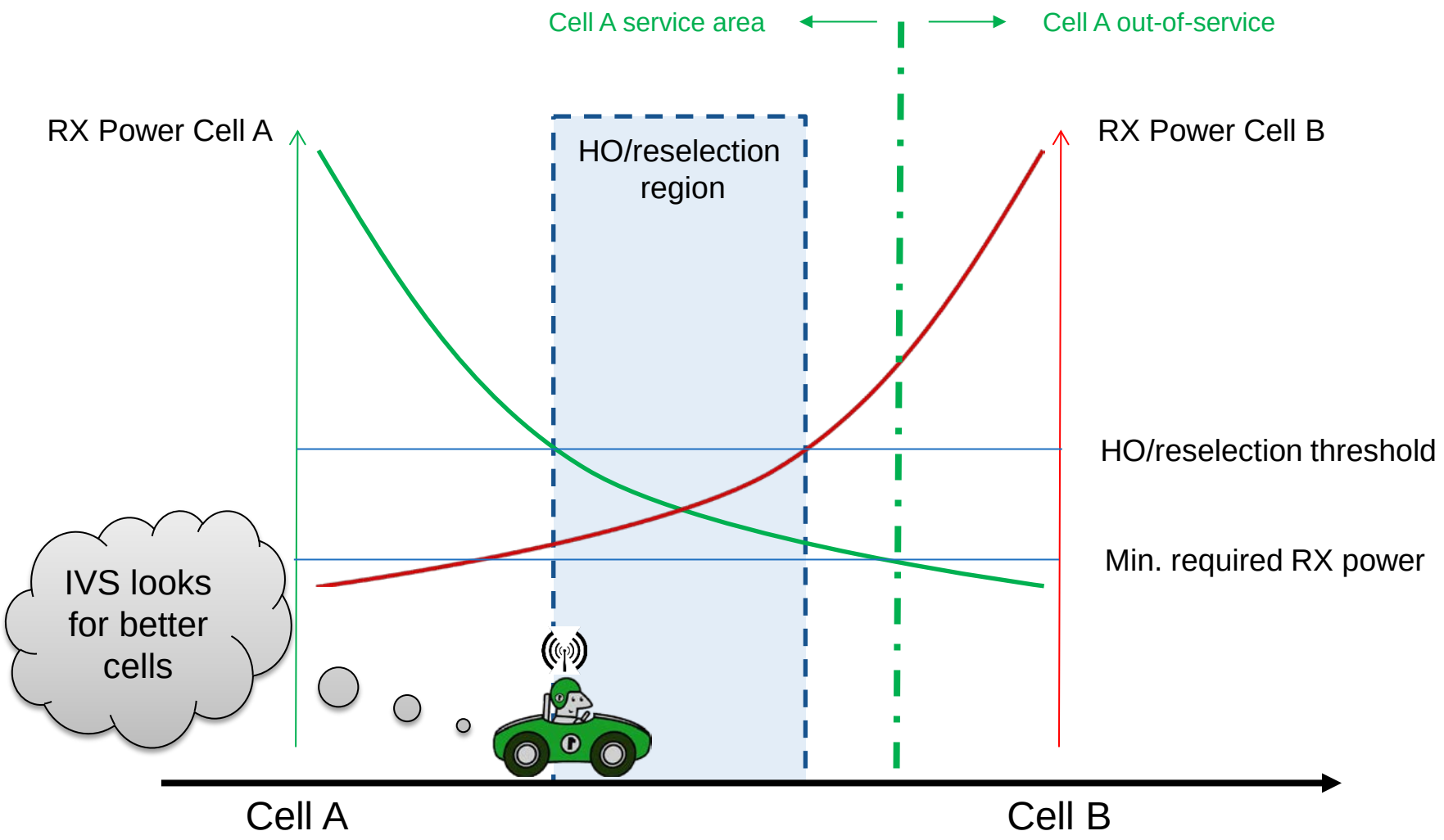
Simplified Cell Border Scenario

- Network planning case for outdoor coverage



Simplified Cell Border Scenario

- Good Case: External antenna



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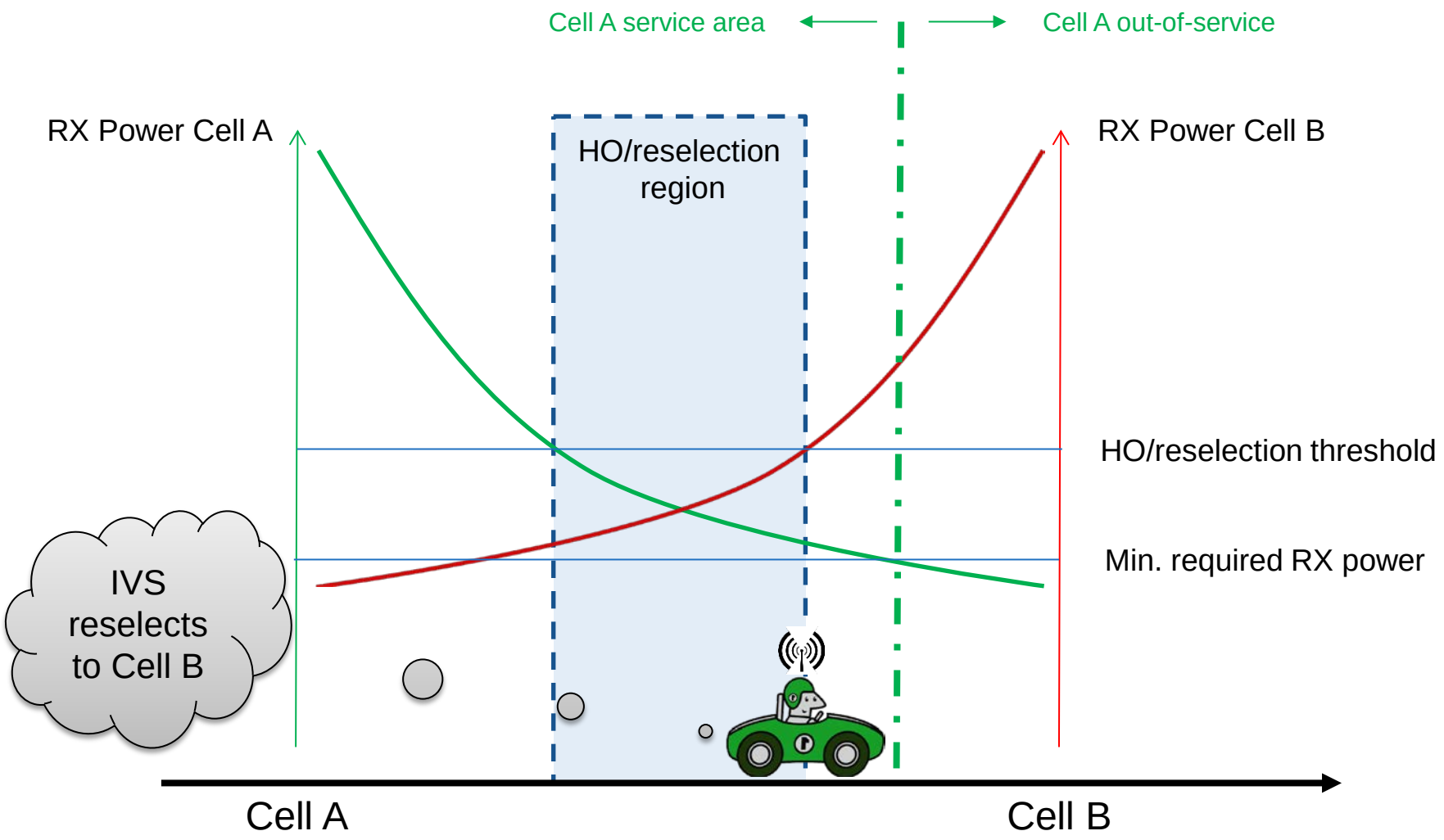

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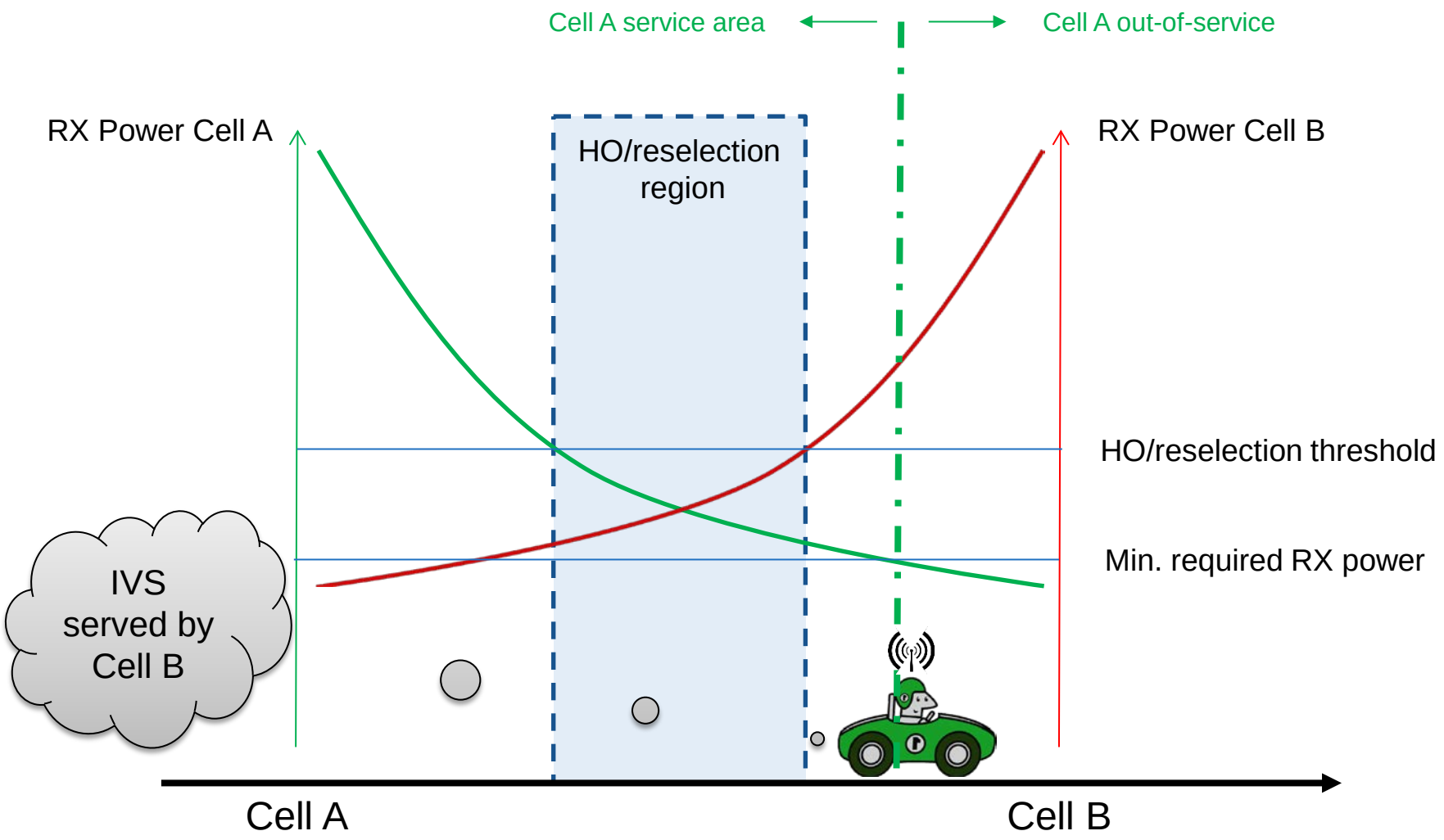
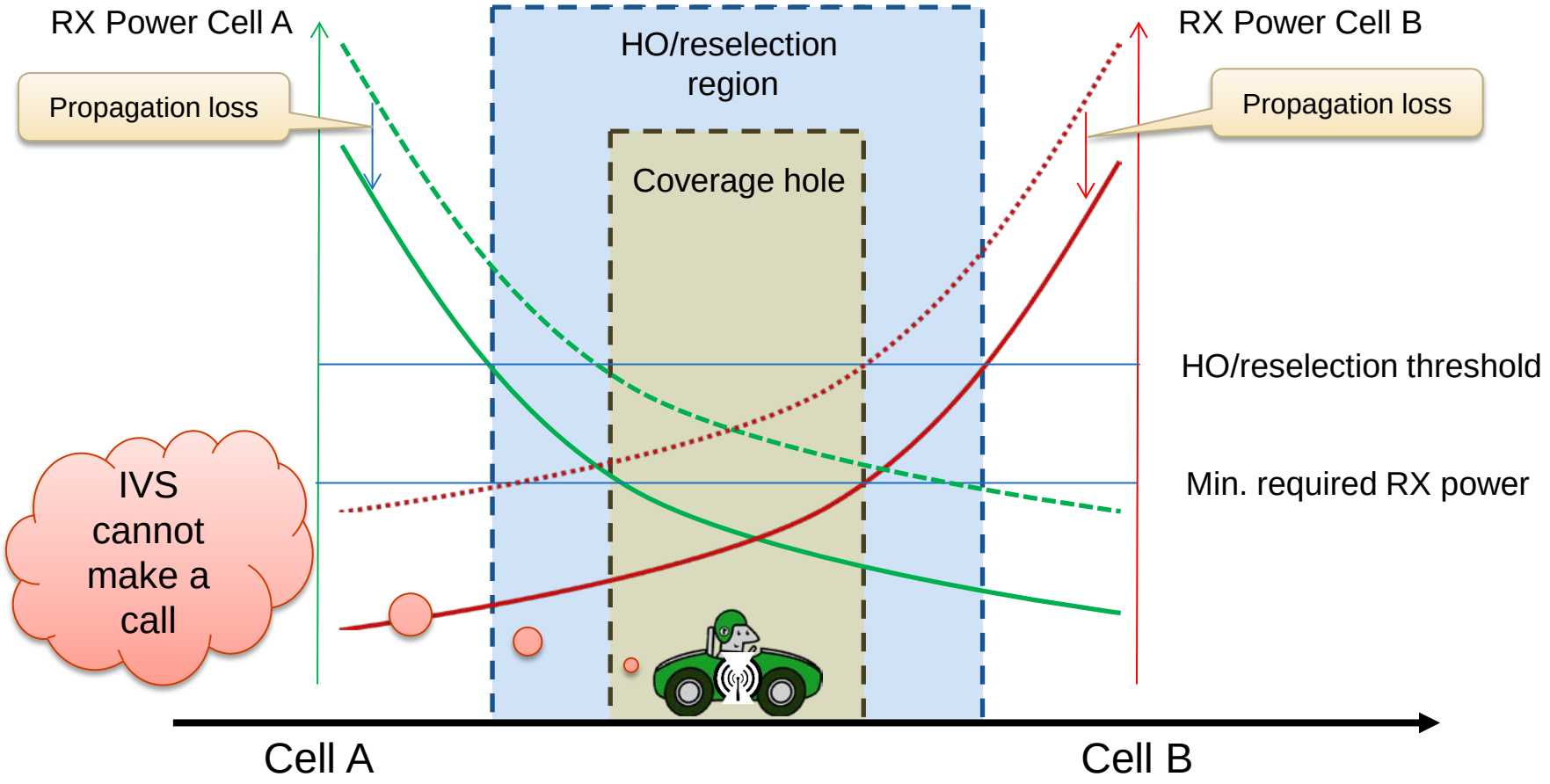


Simplified Cell Border Scenario

- Propagation loss due to in-car antenna placement



Conclusions

- Voice/TS12 emergency calls
  - Networks are configured to prioritize all emergency calls
  - Voice services are typically the best optimized by operators
  - Call setup and retention performance for eCall are the same as for normal voice/TS12 calls

- Network coverage (managed by operators)
  - Urban areas: Network optimized for indoor and outdoor scenarios
  - Rural areas: Network optimized for outdoor scenarios (may or may not include in-car scenario)
  - Typical network planning parameters:
    - Indoor propagation loss: 20dB
    - In-car propagation loss: 10dB
    - External antenna gain: 3-6dB

- eCall performance
  - eCall and voice/TS12 calls experience performance degradations when coverage gets weak
  - eCall performance is reliable even at BLER values exceeding coverage target for voice/TS12
  - Service continuity of emergency calls can only be achieved if device integration is following the typical use case scenario assumed by operators, i.e. outdoor or in-car

Conclusions (cont'd)

- The issue of antenna placement in the car (e.g. IVS embedded antenna)
  - In-car propagation loss can reach ≥20dB in modern cars (e.g. due to shielded windows)
  - Reduced cell coverage can lead to call setup failures or call drops in cell border areas

- GNSS performance
  - Similar considerations apply for GNSS antenna systems
  - Combination of 2G/3G and GNSS antennas possible
  - Position accuracy requirements that are currently defined for eCall on EU and UN level may not be achieved by internal antennas

- Recommendations for antenna system and placement
  - Integrated external antenna system gain should achieve typical minimum 3dB or more
  - Antenna system should be crash resistant or provide enough redundancy
  - Use of only internal antennas is highly discouraged
  - Car type-approval regulation should consider to include antenna requirements to avoid implementation deficiencies leading to significant performance impacts

Thank You !

Questions?

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