



*INTRODUCING THE IDEA OF*  
***“ISM-Advanced”***  
a dedicated band for future  
innovative adaptive co-operating wireless  
networks

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*NB: this is a presentation of joint research idea rather than any formal statement of opinion on behalf of any of COST-TERRA members*

# Need for a “new” band type?

- Existing license-free bands, most notably the 2.4 GHz ISM band, have proven to be a hot-bed of innovation in wireless field:
  - plethora of novel applications and wireless uses
  - boost to standardisation leading to development of hugely popular standards such as WiFi (IEEE802.11), Bluetooth and ZigBee (IEEE802.15)
  - “spill-over” of related innovation to other bands, such as from WiFi to Hiperlan in 5 GHz, WiMAX, etc.
- However, the rich eco-system in 2.4 GHz band is built on essentially one caveat – low transmit power, which severely hampers the scope/range of wireless services

# Stalling innovation

- Opportunistic spectrum access - a heavy burden on new entrants:
  - Onerous technical requirements to protect incumbents from interference
  - Resistance of incumbents “why someone should use for free what I paid billions for?”
  - Competition, disruption of their existing business models, anxiety of spectrum being “encroached”
  - Severe and yet to be defined certification requirements
  - Unclear/unproven “10x-type” applications

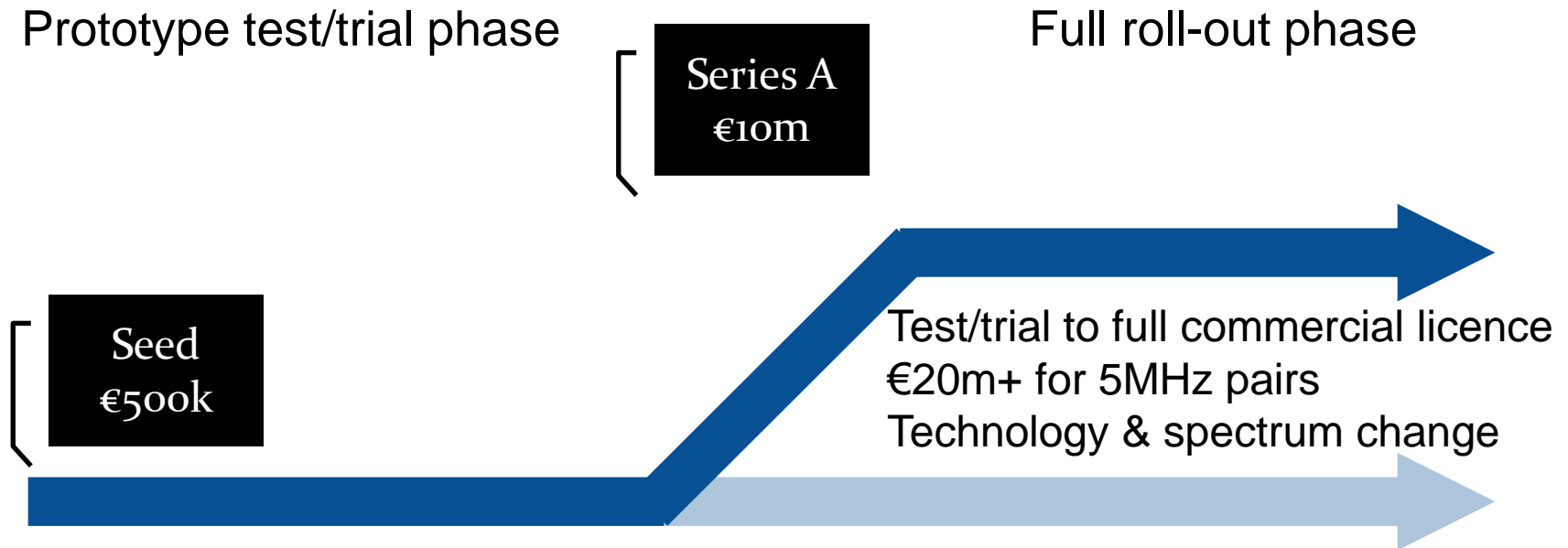
# Introducing a new concept

- Dedicated band for shared use, a kind of “ISM-Advanced” band
- Take the original ISM concept to higher degrees of innovative freedom
  - Boost CR/DSA uptake
  - Long-term band allocation would ensure regulatory stability and attract long-term investments into R&D
  - Any radiocommunications service would be allowed subject only to ITU radio regulations Article 5 restrictions
  - Higher (than in ISM 2.4 GHz band) power limit would be off-set by some generic requirement to use cognitive features to discover neighbours and avoid interference
  - Much more flexibility and higher achievable spectrum efficiency (less guard bands) when not having to work around legacy systems
  - New opportunities for real-life service trial and development of CR technologies before considering broader OSA/DSA

# Supporting innovation

- ISM-Advanced band for public trial and commercial deployment
  - Seamless transition from limited trials to long term full deployment
- Steps up from existing test/trial licensing schemes
  - Special temporary authority (FCC)
  - Non-operational (Ofcom UK)
  - Wireless test and trial licensing (Comreg)
- Low barrier to entry for start-up/spin-out companies
  - Cost structure (if required) scales with subscriber adoption / basestation deployment progress
- Favourable spectrum to support cell-type deployments and small user terminals
- No DTT or PMSE incumbents issue
  - Change of mindset from “protection” to “innovation”

# Relative cost of spectrum

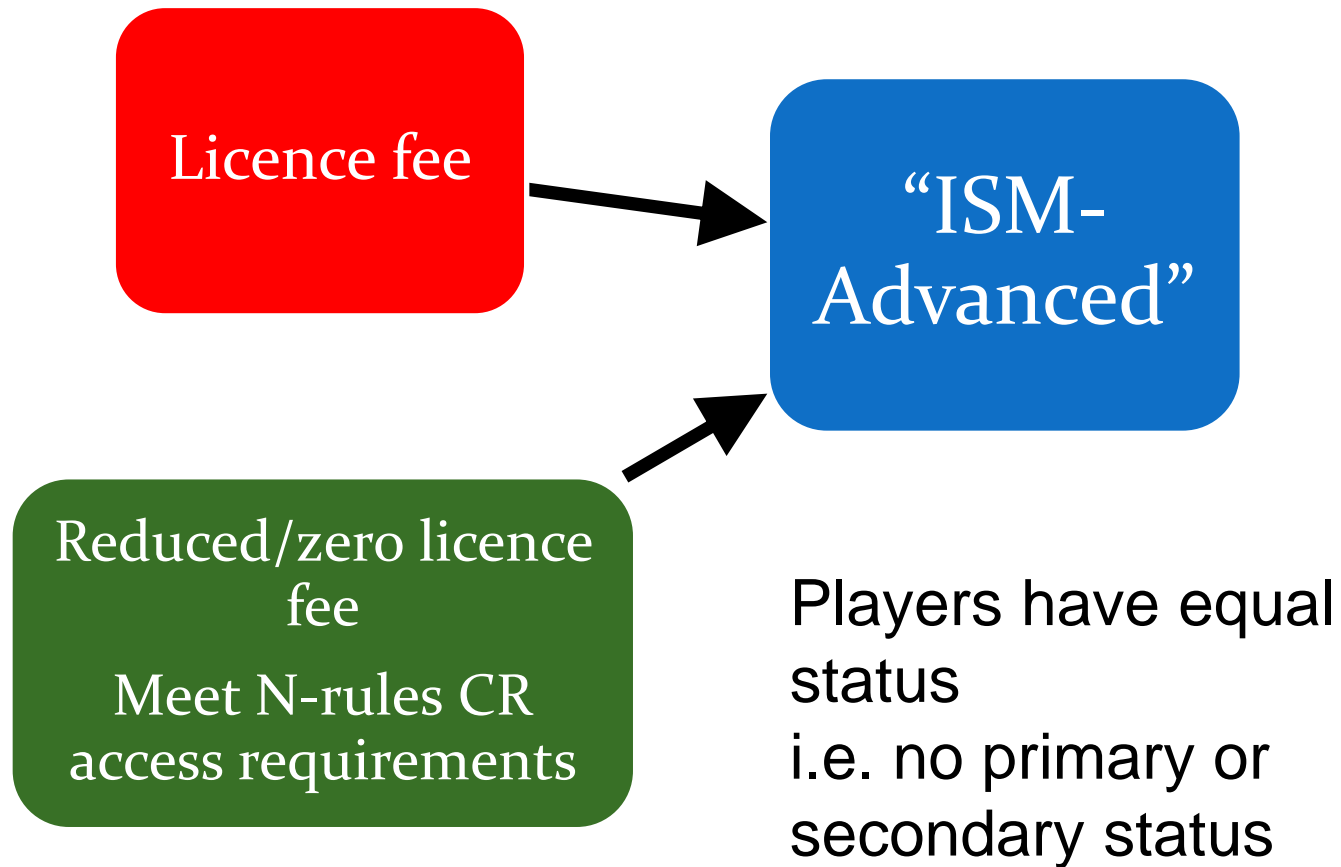


FCC: Special temporary authority

Comreg: Wireless test & trial (€200)

Ofcom: non-operational (£50) – issues 200-300 licences/year

# Dual access



# Potential strategies

- New entrant + new service
  - Commercially viable spectrum
  - Light-touch regulation
  - Sliding cost scales / tie licence costs to success
- Capacity expansion – existing operators
  - “ISM-Advanced” as part of carrier aggregation
  - Non-CR tech can access the band but for higher costs
  - Reduced licencing cost and introduction to shared usage



# Asking whether it is possible?

- Even a comparatively narrow band of few tens of MHz could be sufficient to bring the ISM-Advanced concept to reality
- Some possible opportunities for finding one or more “clean” bands for “ISM-Advanced”:
  - Slots freed by transition to more spectrum efficient digital Broadcasting (Second Digital Dividend)
  - Still largely unused TDD portions in land mobile (IMT-2000) frequency plans
  - Little used 1452-1492 MHz L-band (currently under review in CEPT/ECC FM50)
  - UK MoD spectrum release [2310-2400, 3400-3600]

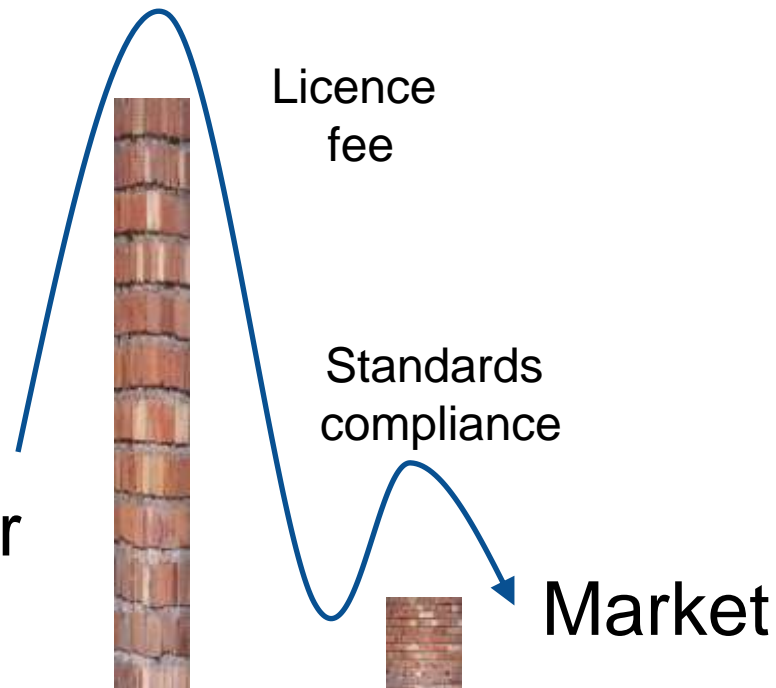
# Over to you

- We welcome comments and submissions
- For more information on COST Action ICo905 TERRA and how to contribute: **[www.cost-terra.org](http://www.cost-terra.org)**
- This work has been partially supported by the ICT-ACROPOLIS Network of Excellence, FP7 project number 257626, **[www.ict-acropolis.eu](http://www.ict-acropolis.eu)**

# Backup slides with additional details

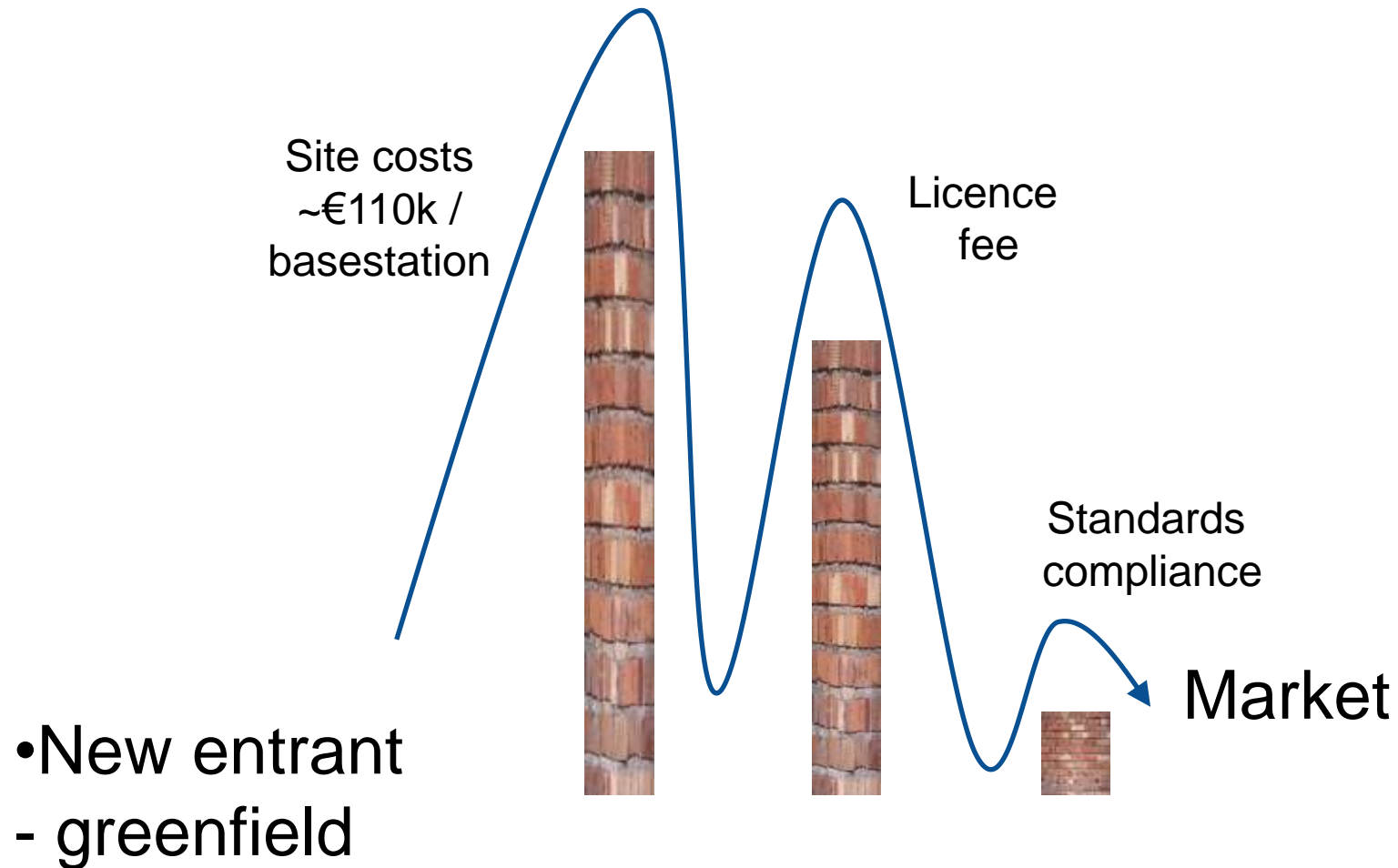
# Cellco – regulatory barriers

- Diversifying operator



\*Excluding site and infrastructure costs & OPEX

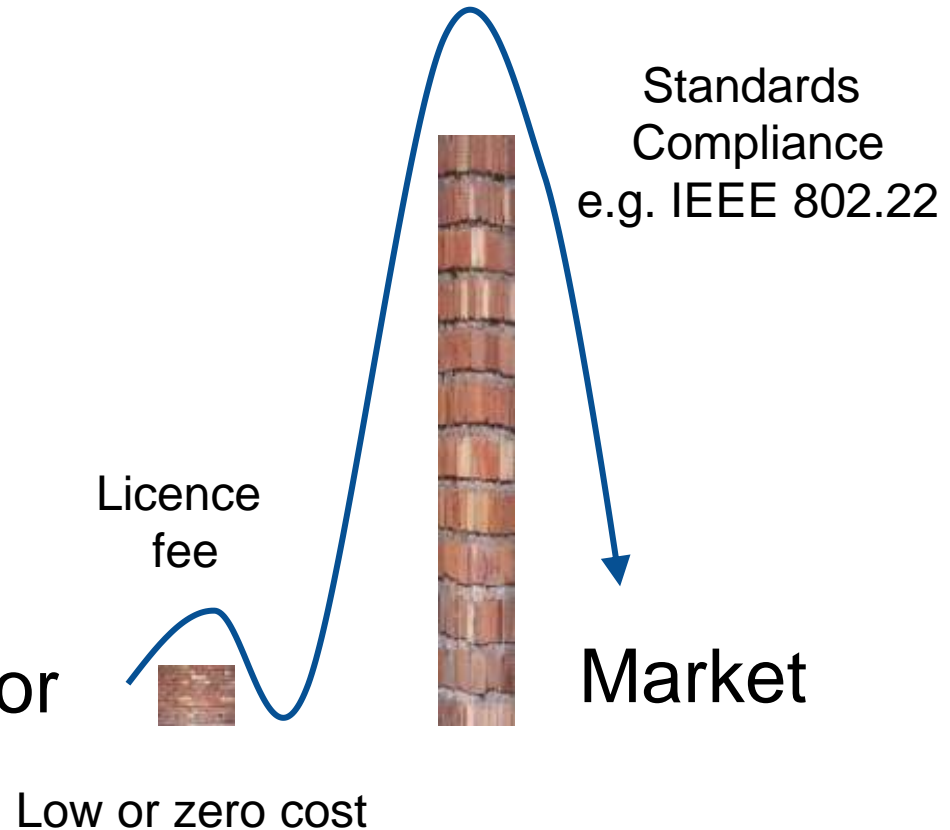
# Greenfield cellco – regulatory barriers



Excluding OPEX

# TVWS – regulatory barriers

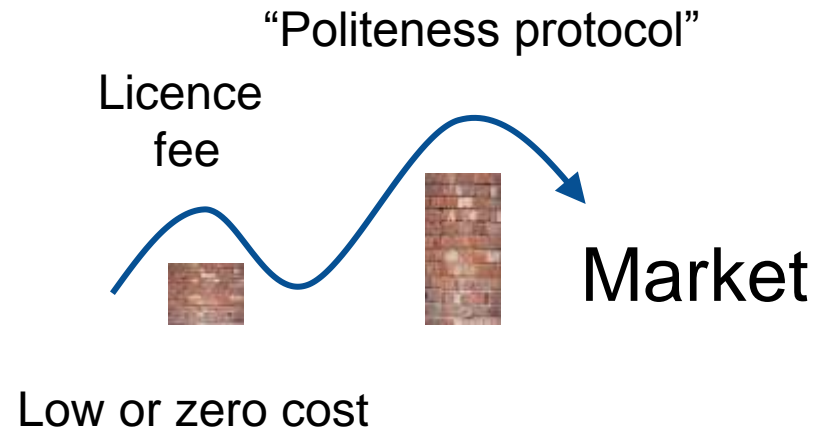
- New entrant
- Diversifying operator



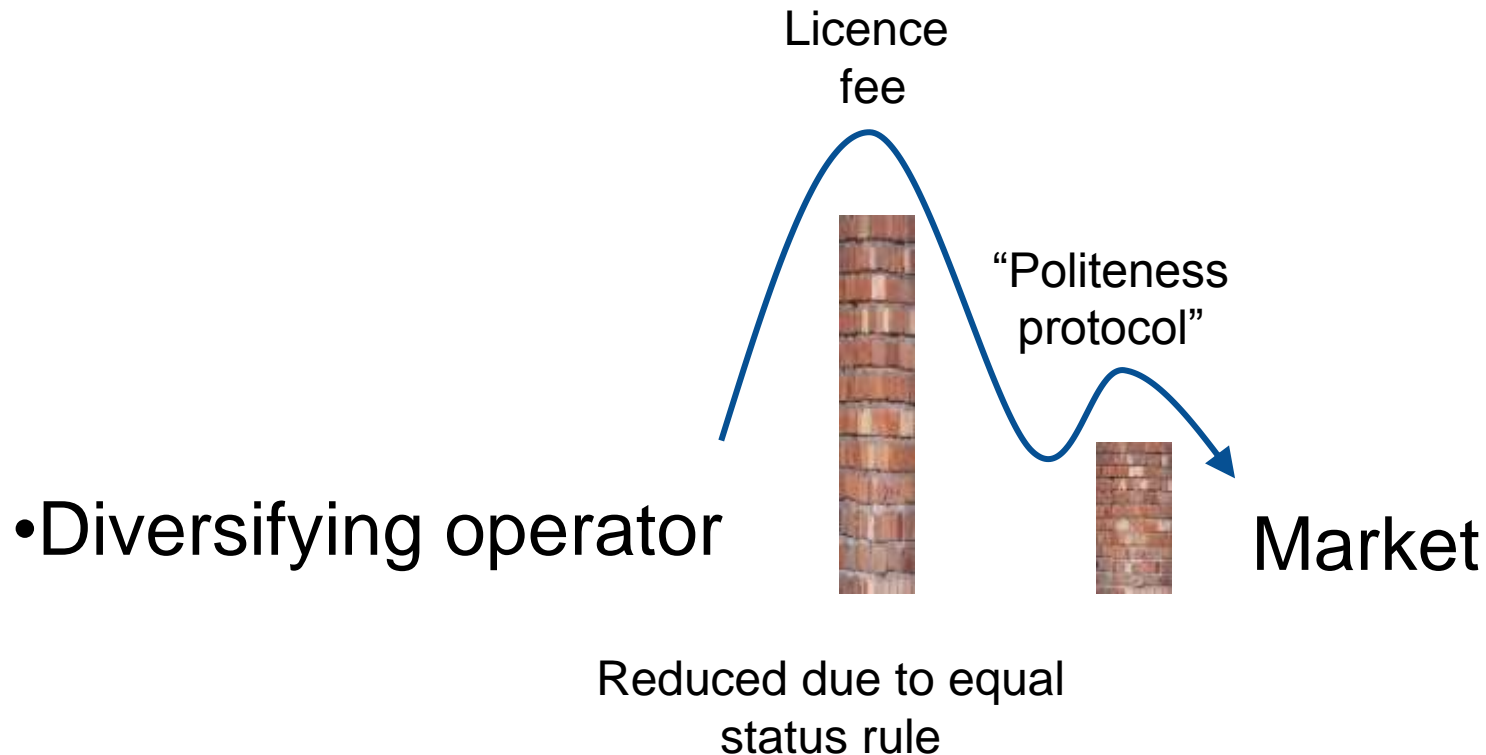
Excluding site and infrastructure costs & OPEX

# Regulatory barriers – ISM Advanced

- New CR entrant



# Regulatory barriers – ISM Advanced





# Access requirements (II)


## Example of how it might work

 = **Priority Access**

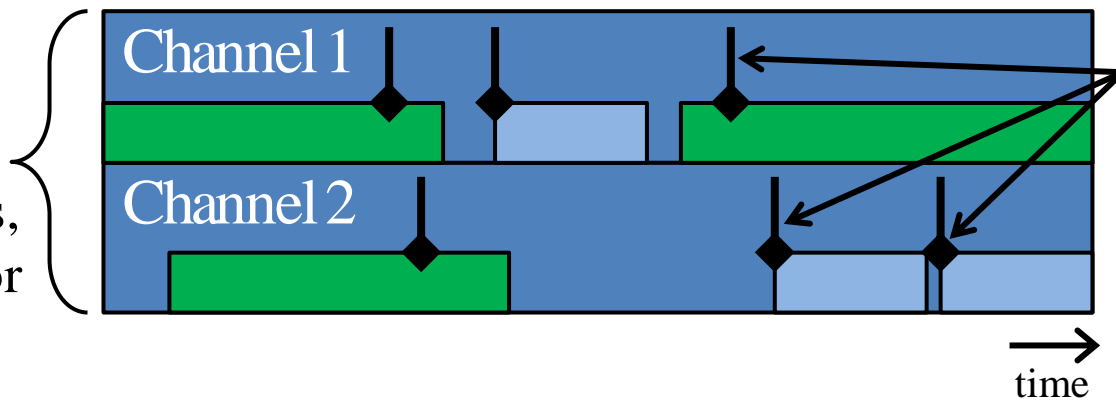
Licence fee paid: No need to use cognitive access (no sensing or possible geolocation checks—can transmit whenever wished, without checks).

 = **“Cognitive” Access**

### **Transmissions**

Reduced/zero licence fee:  
Must implement CR access requirements (sensing durations—represented by , possible geolocation).

Dedicated  
Cognitive Radio  
Band: Players  
have equal status,  
i.e., no primary or  
secondary



Cognitive access  
sensing durations  
before  
transmissions

# Some links

- Recent news showcasing the problem of interference in ISM band:
  - <http://www.securityweek.com/smart-meters-interfering-home-electronics>
- Yet another clash over frequency access:
  - [http://www.techworld.com.au/article/408425/spectrum\\_clash\\_builds\\_around\\_bionic\\_implants](http://www.techworld.com.au/article/408425/spectrum_clash_builds_around_bionic_implants)
- CEPT work on trying to decide what to do with idle band 1452-1492 MHz:
  - <http://www.cept.org/ecc/groups/ecc/wg-fm/fm-50>
- European RSPG consultation on what to do with unused TDD blocks in 2 GHz land mobile band (deadline 18 January 2012):
  - [http://ec.europa.eu/information\\_society/policy/ecomm/radio\\_spectrum/activities/index\\_en.htm#ongoing\\_consultations](http://ec.europa.eu/information_society/policy/ecomm/radio_spectrum/activities/index_en.htm#ongoing_consultations)