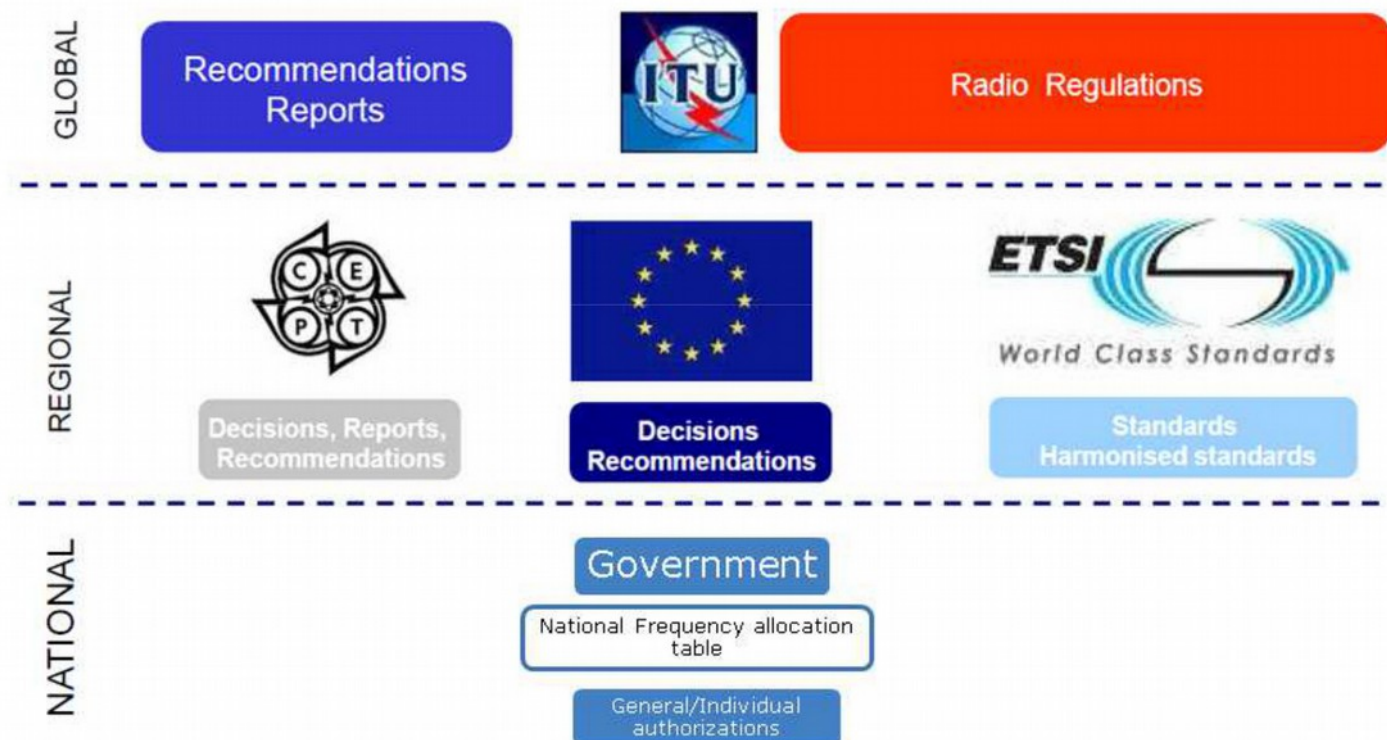


ETSI workshop on Reconfigurable Radio Systems

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What is ETSI?

- European Telecommunications Standards Institute
- Headquarters in Sophia Antipolis, France

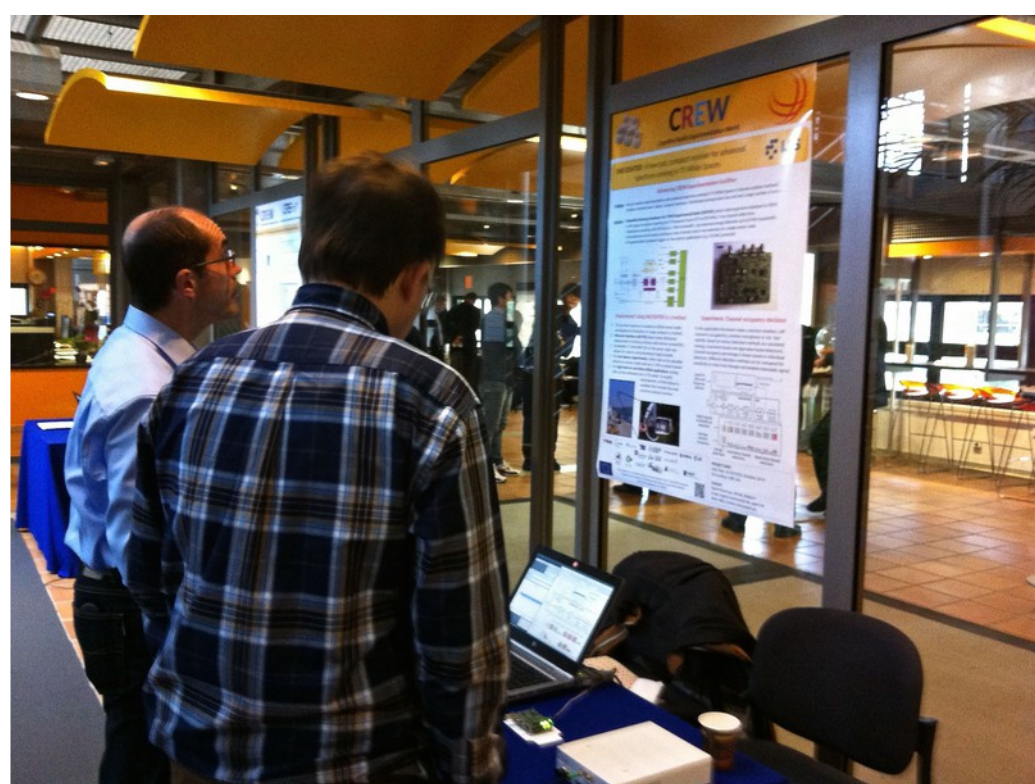


Workshop overview

“To report on the current and future standardization activities related to reconfigurable radio systems”

- Small, 2 day event
 - 10 sessions, 3 tutorials, 12 demonstrations (3 from CREW)
 - + some accompanying, more in-depth events which I didn't attend.
- Around 80 attendees
 - Industry (HW manufacturers, network operators), research institutions and universities, local regulators

<http://www.etsi.org/news-events/events/807-etsi-rrs-workshop-2014>



Standardization: where we are?

- ETSI Technical Committee for RRS advises decision makers
 - e.g. TS 102 969: Radio Reconfiguration related Requirements for Mobile Devices
- EC Mandate M/512
 - “enable deployment of cognitive radio systems”
 - licensed shared access through geolocation DB.
 - mobile broadband (LTE) 2.3 – 2.4 GHz
- Radio Equipment Directive (RED)
 - Requirements for wireless/radio communication products
 - On June 2016 will replace old R&TTE directive from 1999

A **mandate** is a demand from the European Commission to the standardization organizations to draw up and adopt European standards. European standards remain voluntary in their use.

A **directive** is a legal act of the European Union, which requires member states to achieve a particular result without dictating the means of achieving that result.

RED and cognitive radio

- No specific arrangements in RED for cognitive radio
- Software is an accessory (same as antenna, etc.)
- Declaration of conformity: HW manufacturer must specify which accessories ensure compliance.

“radio equipment supports certain features in order to ensure that software can only be loaded into the radio equipment where the compliance [...] has been demonstrated.”

“Ensure that the equipment can be used only for the intended purpose declared.”

RED, Article 3(3)(i)

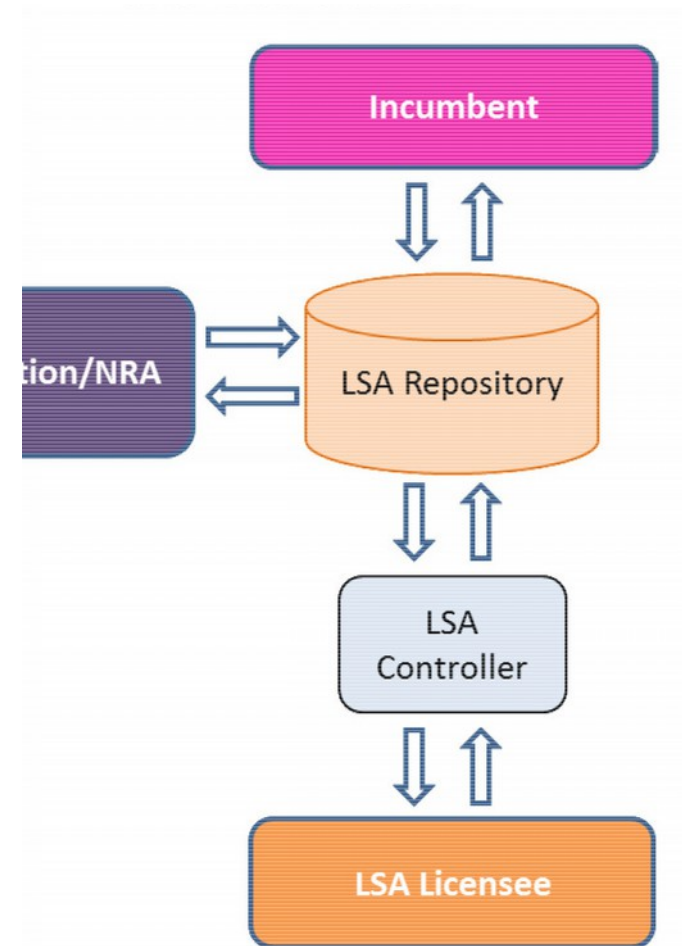
- Devices must include a “lock” that prevents non-compliant software from being uploaded.
 - “there will be exceptional cases”
(e.g. people hacking the lock)
- If adopted, this requirement is essential, similar to requirements for harmful interference.
 - How to standardize and test the requirement?
(*How to specify the “strength” of the lock? What kind of testing procedure can be defined to ensure compliance?*)
 - Restricts market competition
(*HW manufacturer can lock out alternative software*)

RED, Article 3(3)(i)

- There must be a single responsible entity for ensuring compliance. Who?
 - Modern devices consist of modules from different vendors.
- Is it even feasible to assign conformity to software?
 - Why is changing radio software any different from changing a capacitor?
- Virtual machine approach?
 - Is it feasible to have a virtual machine that could force software to be compliant with RED?

Licensed Shared Access

- New spectrum user shares spectrum with incumbent.
 - Must make sharing agreement with incumbent, LSA Licensee has some assurance for QoS.
 - cf. no guarantee for WSD
- First application on 2.3 - 2.4 GHz
 - Incumbents PMSE, telemetry, fixed links, etc.
 - Different in each country.
 - Implemented on national level on voluntary basis.



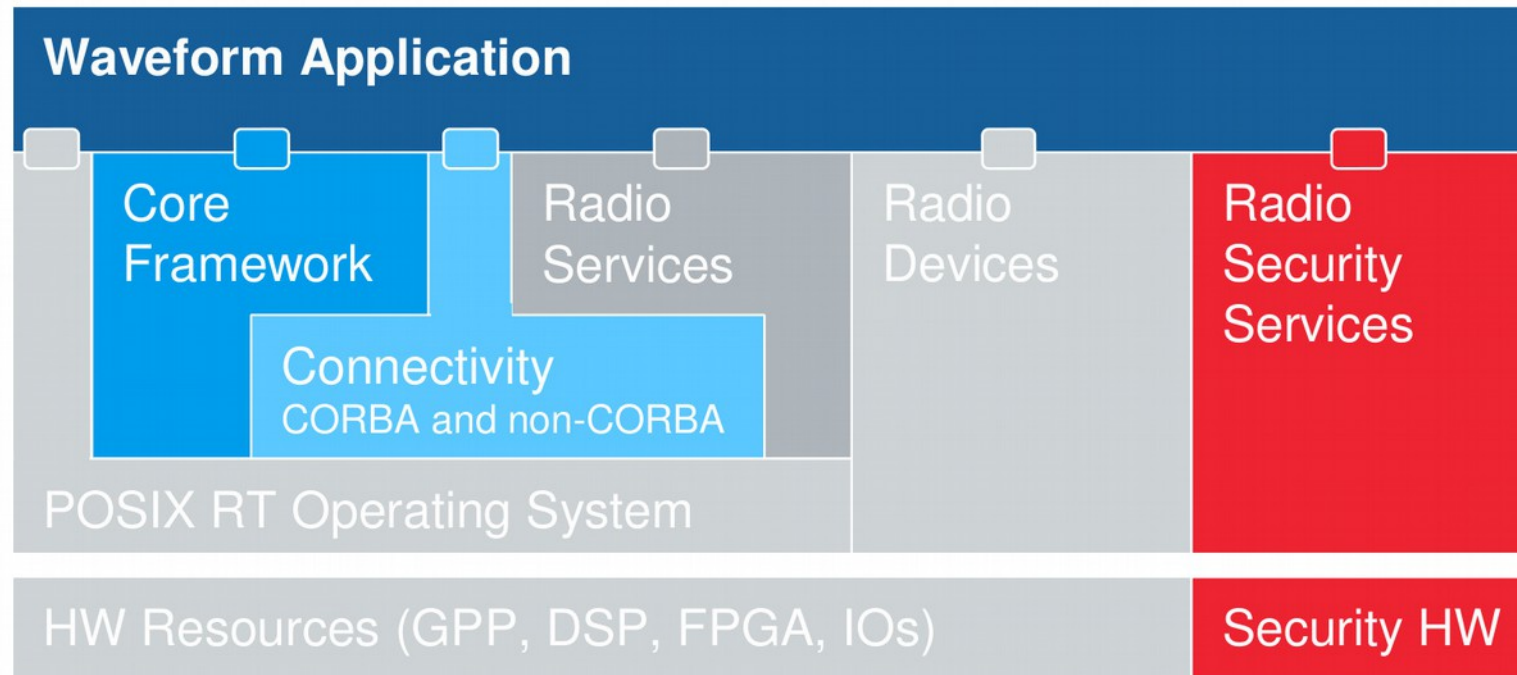
Licensed Shared Access

- Finland trial, September 2013
 - Coexistence with naval, air-borne radar @ 3.5 GHz
 - LTE small cells require 0 – 15 miles off-shore exclusion zone
- LTE in licensed shared spectrum
 - Candidate frequencies 2.3, 2.6, 3.5 GHz
- Efforts to apply this model also to TVWS
 - ECC report 204 – requirements for cognitive-PMSE, demonstrator hardware already available.

Public safety applications

- Police, fire departments, ... want broadband
 - real-time video, maps, telemedicine, databases ...
 - existing narrowband TETRA, TETRAPOL can't provide it.
- No spectrum available (10 MHz BW, <1 GHz)
 - can't retire old services in foreseeable future (2030 or beyond)
- Solution: use existing 400 MHz band
 - Demo of broadband with disabled subcarriers to clear TETRA channels.
 - “refarming” - reorganize TETRA to minimize wasted spectrum.
- Other options:
 - 700 MHz band (general pessimism about the digital dividend)
 - Use commercial networks (doubtful that providers can provide QoS)

SW Communications Architecture

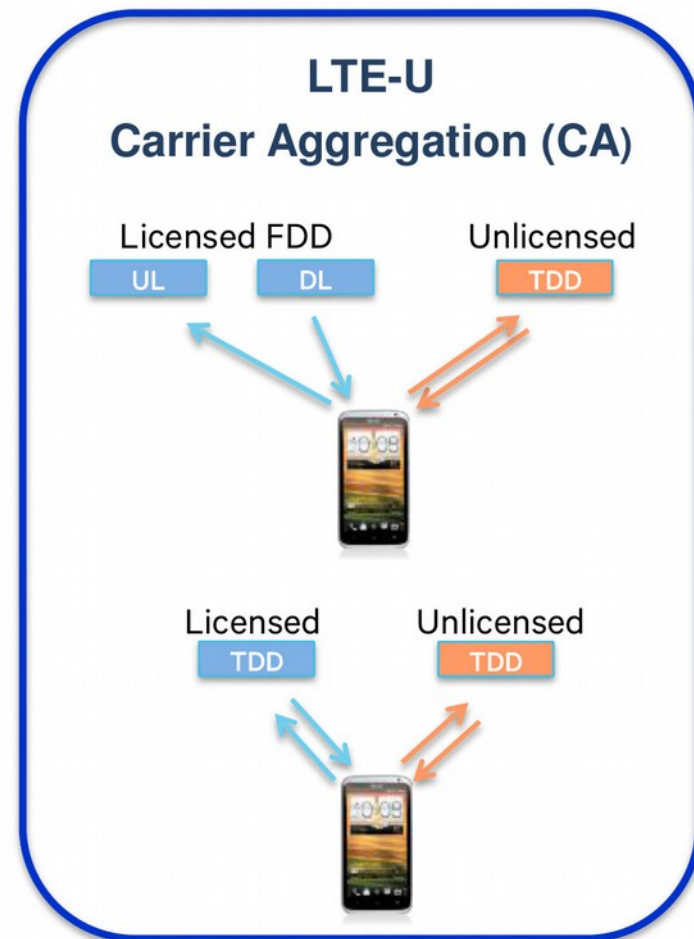
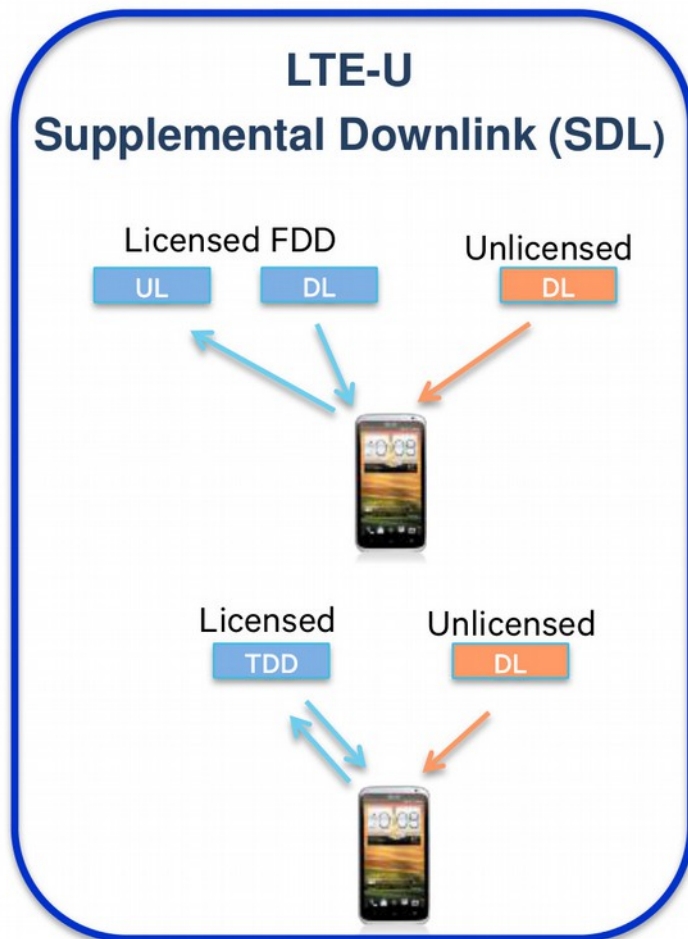


The objective of the SCA standards is two-fold:

- To provide the mechanisms required to deploy waveform applications
- To standardize the interfaces of the platform to the waveform applications

LTE in unlicensed bands

- “Licensed Assisted Access” == LTE-U



LTE in unlicensed bands

- Always in conjunction with a licensed band
 - control signals always go through licensed band, unlicensed channels only for UL/DL bandwidth increase.
 - cca. 2x more access points required for coverage.
 - cca. 2x bandwidth increase.
- 5 GHz exclusively (no plans for 2.4 GHz)
 - features to protect IEEE 802.11 (should not impact wi-fi performance)
 - LTE performs better than IEEE 802.11 in same environment (superior MAC, better error correction)

Ofcom TVWS trials

- UK pilot program “to explore the potential benefits and issues of the new technology”
- 8 geolocation databases qualified by Ofcom
 - “market will decide if we need this many”
 - 50.000 PMSE assignments (i.e. wireless mics)
 - Coverage of 6 DTV national broadcasts + some local channels calculated for 100x100m pixels by Ofcom
 - Devices ask the GDB for permission to transmit, but there is no standardized coordination between secondary users.
- Ofcom has ability to switch off any device automatically within 15 minutes.

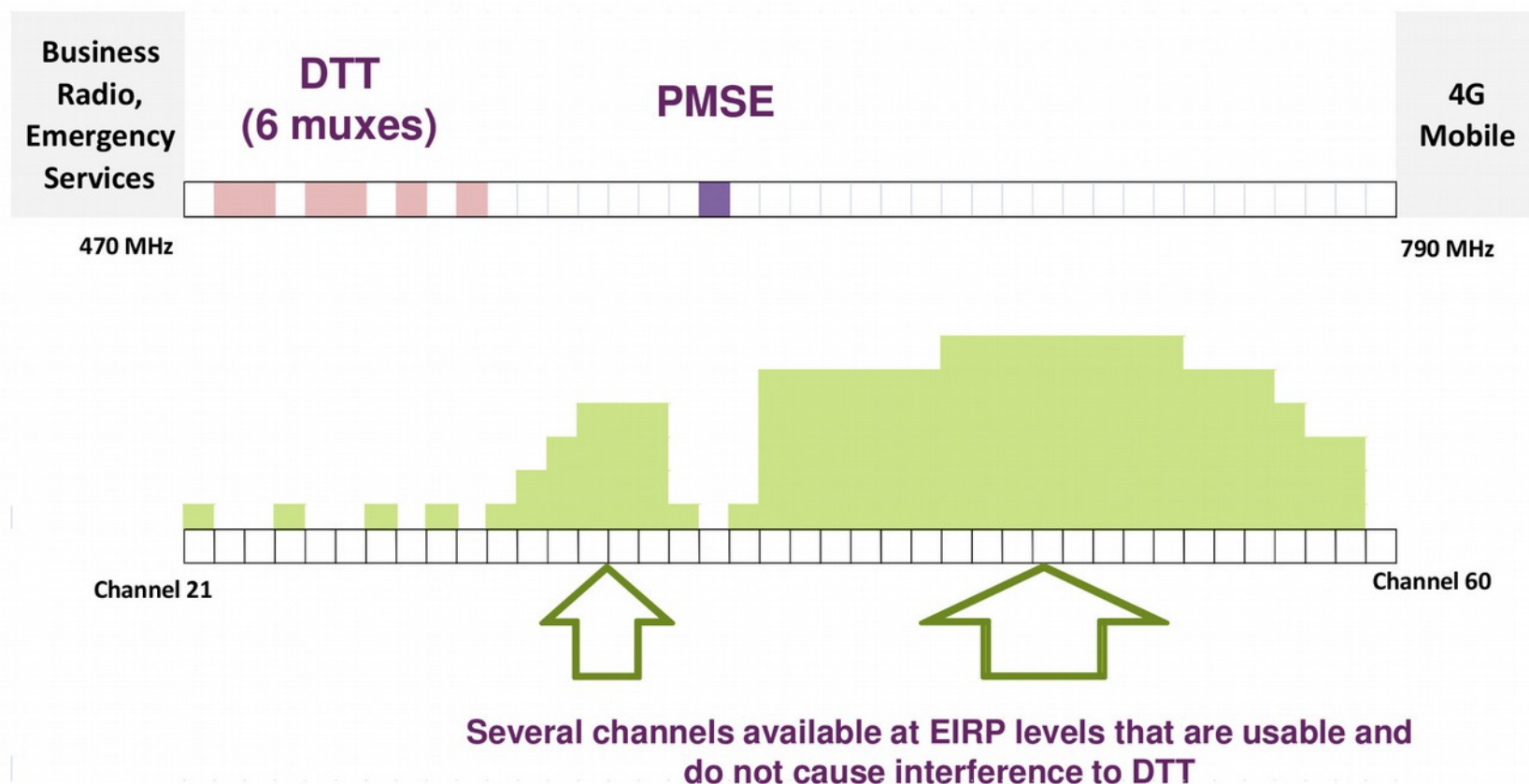
Ofcom TVWS trials

- Devices are required to comply with ETSI EN 301 598
 - in practice many devices do not comply (e.g. many devices built according to U.S. standards, early prototypes)
- Databases had to go through an exhaustive process of qualification
 - Reason for many delays with the trials.
- General pessimism regarding current TVWS scheme
 - Very few participants think that TVWS use will take off.
 - More trust in the LSA scheme because it is better controlled.
- Ofcom will publish TVWS statement in early 2015
 - start of operations predicted before end of 2015.

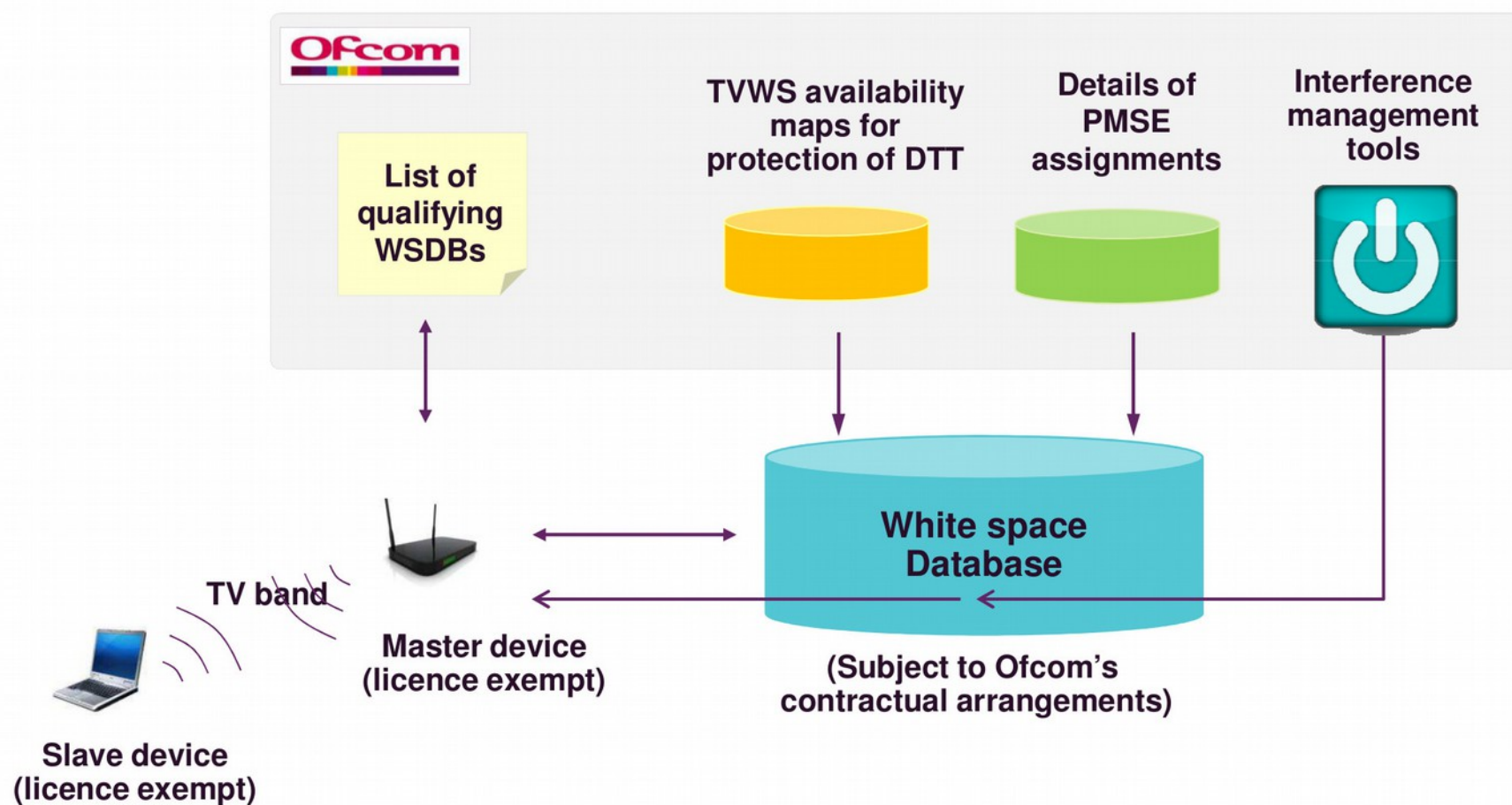
The TV White Spaces opportunity



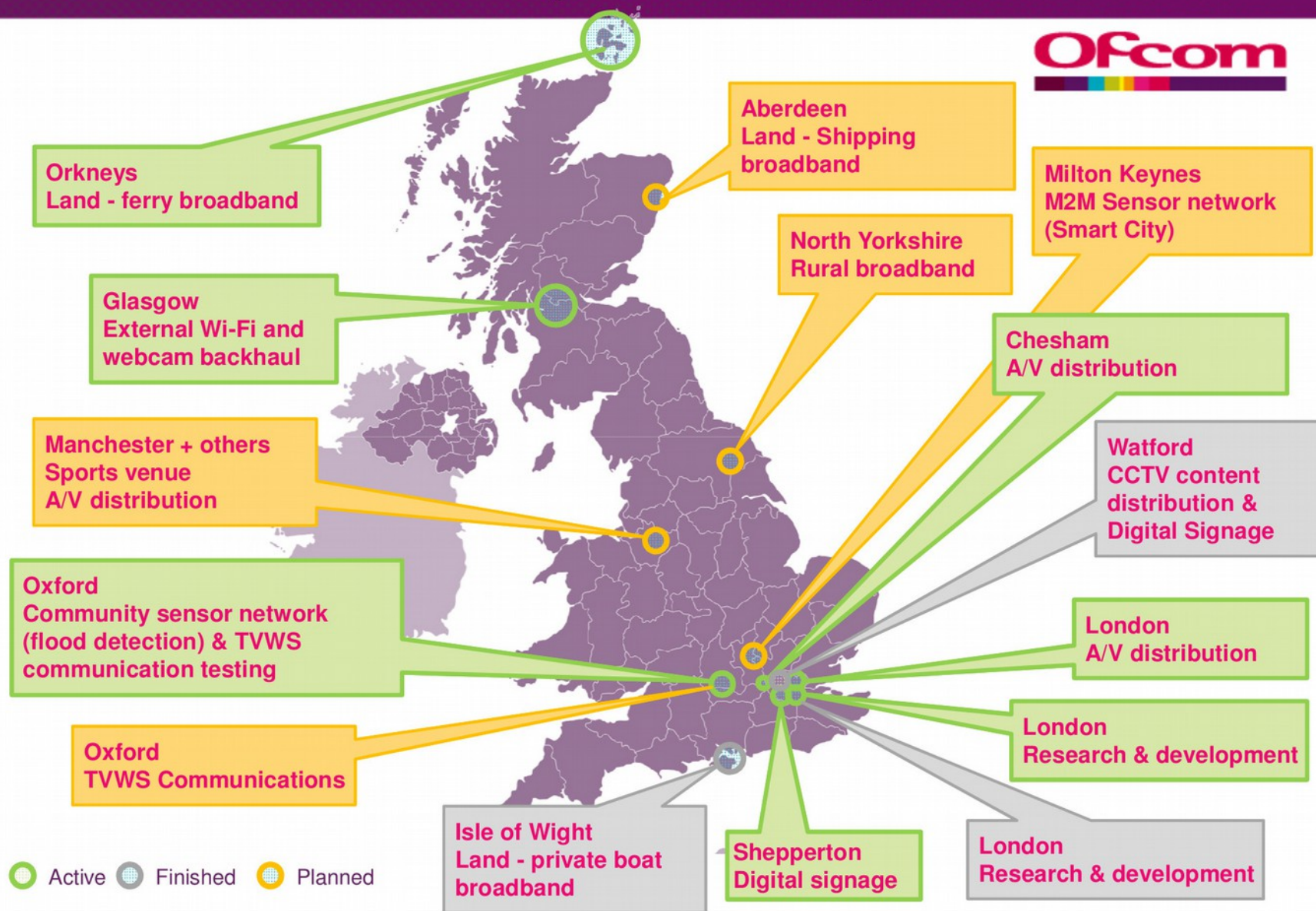
What does the TV band occupancy look like at a random location in the UK?



Framework for access to TVWS in the UK



We have received 19 requests to set up a trial



Questions?

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*“The fact that nothing interoperates makes
everything difficult.”*