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# Requirements and Coexistence Topics for LTE-U

## 3GPP LTE-U Workshop
## Sophia Antipolis, 13 June 2014

RWS-140010

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# Agenda

- General LTE-U requirements and study areas
- LTE-U coexistence use cases
- LTE-U coexistence methods

# LTE-U Requirements and Study Areas

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## General Requirements

- LTE-U should focus on a section of the 5GHz band that will be globally available
- LTE-U channel allocation method must be fair providing LTE-U and Wi-Fi the same statistical likelihood for allocating and utilizing a channel
- LTE-U should use 20MHz channel separation, which matches the Wi-Fi channel separation

## Proposed Study Areas for Rel-13 LTE-U

- Investigate a Time Division protocol for In-Device Coexistence
- Investigate remote sensing mechanism for optimized channel selection
- Investigate if LTE-U should use Wi-Fi packets and methods for coexistence
- Investigate spectrum and interference management by using database

# LTE-U Coexistence Use Cases – In Device

- In-Device coexistence during LTE-U and Wi-Fi dual operation needs to be studied
  - To simplify standardization, initial LTE-U study should focus on the LTE-U DL only

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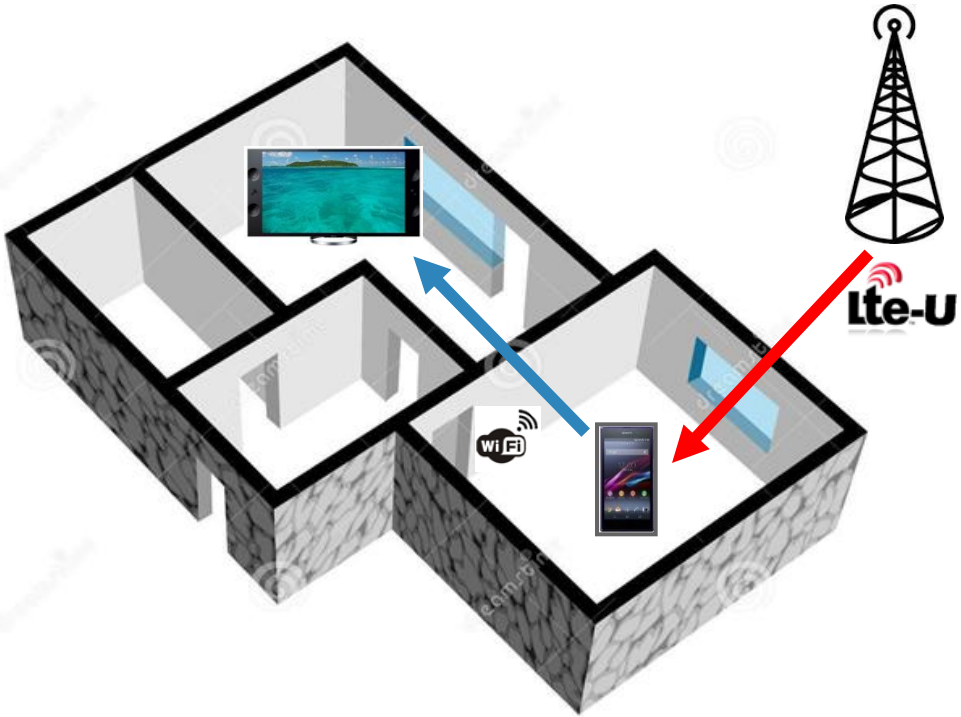
- Example Dual Operation
  - LTE-U + Adhoc D2D Wi-Fi
    - PLMN streams video to UE via LTE-U and the UE forwards it to a TV using Wi-Fi direct

# In-Device Coexistence - Home Entertainment Scenario



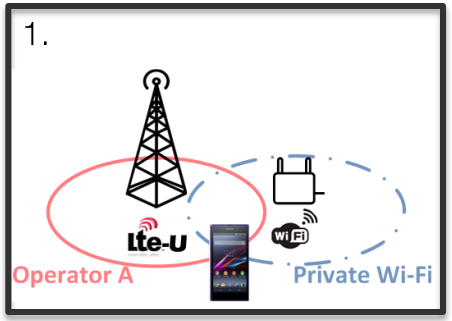

## Scenario

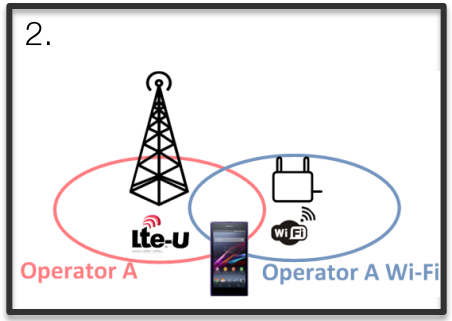
1. UE receives streamed video over LTE+LTE-U
2. UE relays the video over Wi-Fi to TV
3. UE needs to coordinate the Tx and Rx, to prevent Wi-Fi TX to block LTE-U Rx
4. Time Division (TD) multiplexing is needed

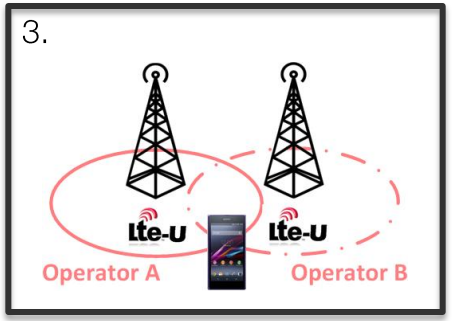
**Proposal:** Investigate TD protocol for Wi-Fi Tx and LTE-U Rx co-existence

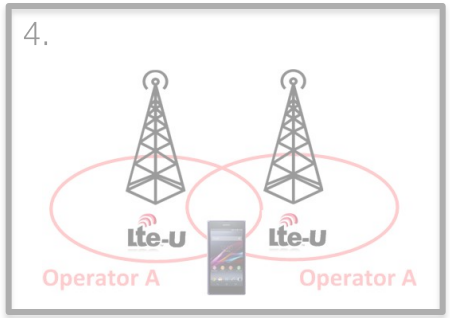
# LTE-U Coexistence Use Cases - System

- Coexistence use cases to be studied
  1. Coexistence between LTE-U and unmanaged Wi-Fi
  2. Coexistence between LTE-U and managed Wi-Fi
  3. Coexistence between LTE-U operation with multiple operators
  4. Coordination and planning of LTE-U operation within a single operator

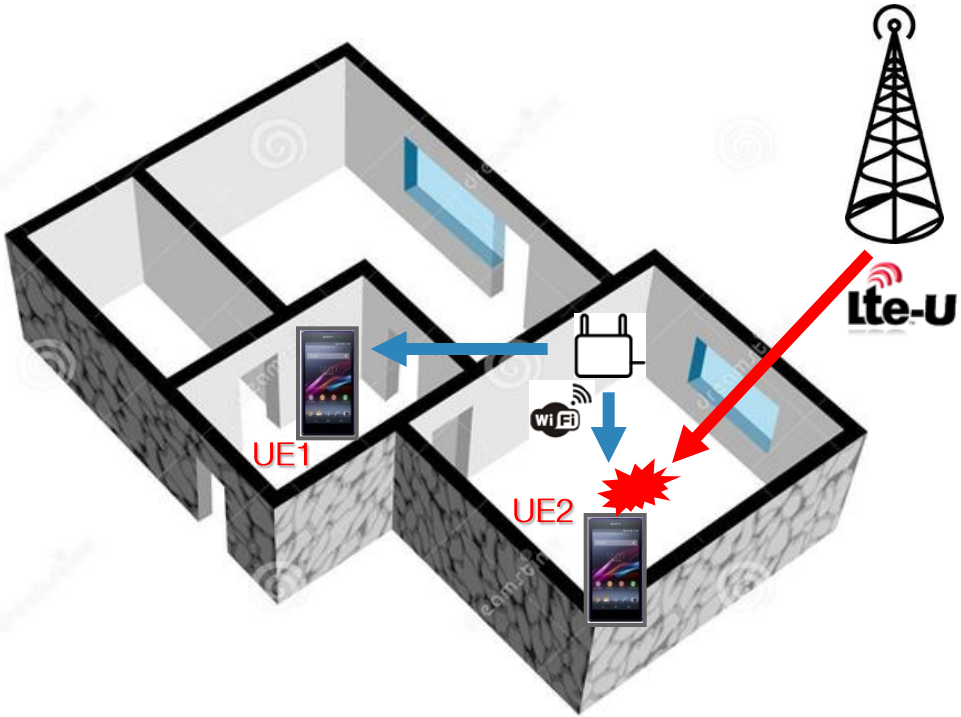


# Hidden Node Problem for Unmanaged Wi-Fi




Scenario

1. UE1 is communicating with Home Wi-Fi AP
2. UE2 is communicating with LTE-U eNB
3. Home Wi-Fi AP signal causes interference at UE2
4. LTE-U eNB can not sense the Wi-Fi AP signal

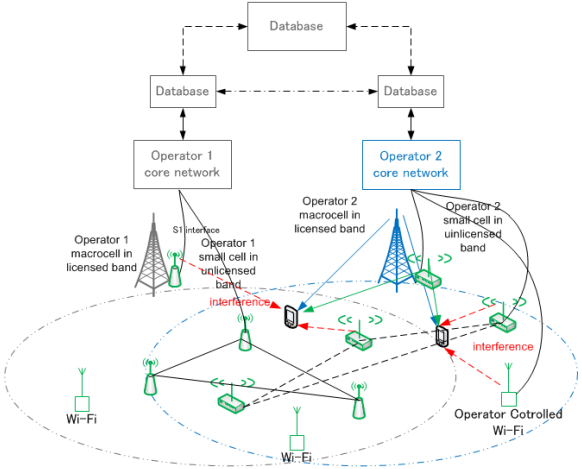
**Proposal:** Investigate remote sensing mechanism for optimized channel selection

# LTE-U Coexistence Methods

- Investigate if LTE-U should use Wi-Fi packets and methods
  - Investigate Physical RF sensing and Virtual channel sensing (802.11 Network Allocation Vector functionality)
  - Investigate if the eNB should send Wi-Fi like beacons, so the Wi-Fi APs and STAs can detect/avoid the eNB

- Investigate methods for information exchange and management
  - Geo-location information of Wi-Fi access points and LTE-U eNBs
  - AP and eNB channel allocation statistics
  - Interference characteristics based on calculation and measurements

# LTE-U Coexistence – information exchange




*Information sharing enables intelligent channel selection/allocation for LTE-U and/or managed Wi-Fi*

- Coexistence between LTE-U and managed Wi-Fi
  - Expanding network planning to take LTE-U and managed Wi-Fi access points into account
- Coexistence between LTE-U operations with multiple operators
  - Intelligent information sharing of channel allocations for LTE in the unlicensed band
  - Providing an interrogation mechanism cross operator borders whilst keeping deployment information internal to all involved parties
- Coordination of LTE-U operation within a single operator
  - LTE-U small cells measure spectrum environment requested by the core network and report its channel information, interference power level, geo-location information, etc. to database managed by operator

# Summary

- LTE-U channel allocation method must be fair providing LTE-U and Wi-Fi the same statistical likelihood for allocating and utilizing a channel
- LTE-U should focus on a section of the 5GHz band that will be globally available
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- Initial LTE-U study should focus on the LTE-U DL only

- Investigate a Time Division protocol for In-Device Coexistence
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