

Consideration on LTE operation in unlicensed spectrum

LG Electronics

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Introduction (1/2)

➤ The Main Drivers of LTE-U

Dramatic increase of mobile traffic

Scarcity of available licensed spectrum

Attractiveness of cost-effective unlicensed
spectrum

LG supports the introduction of LTE-U in 3GPP

Introduction (2/2)

➤ The benefits of LTE-U

Improved economies of scale with LTE in both licensed and unlicensed bands

Higher spectral efficiency than WiFi due to efficient radio protocol

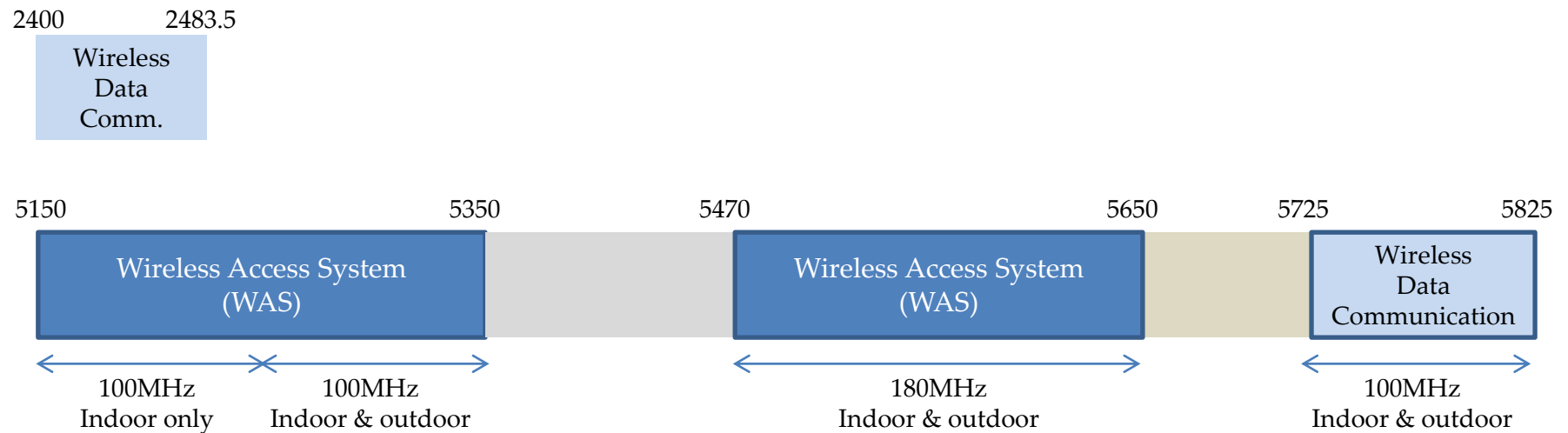
Efficient utilization of unlicensed spectrum
(improved user experience with carrier aggregation)

LG shares the benefits of introduction of LTE-U in 3GPP

LTE-U spectrum in Korea

➤ Spectrum for LTE-U [1]

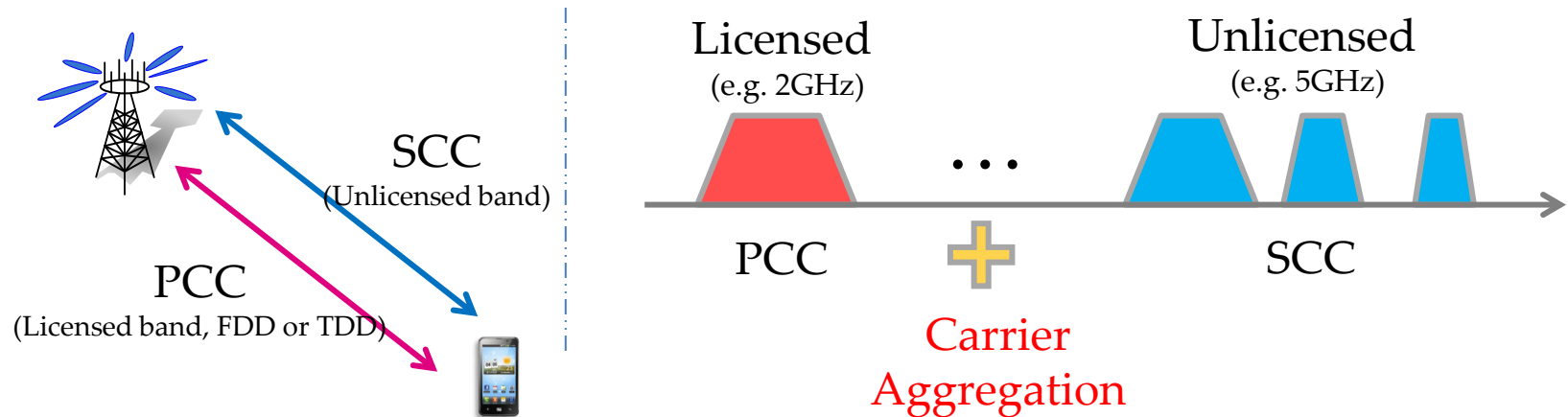
- Spectrum for low power devices for WAS (Wireless Access System)
 - 5150~5650 MHz
- Spectrum for low transmission power device for wireless data communication system
 - 2400~2483.5 MHz
 - 5725~5825 MHz



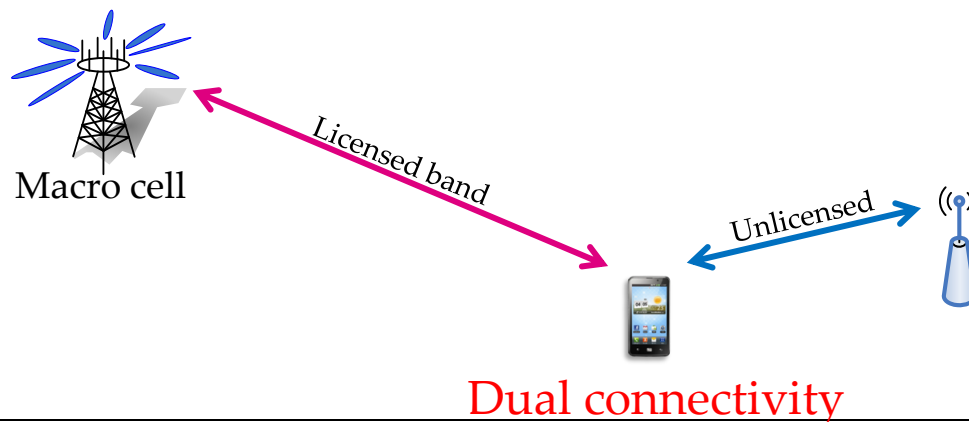
[1] Korean regulatory requirements, Part 29 regulation (rev.2013-157)

Deployments Scenario for LTE-U (1/2)

- Carrier aggregation scenario should be the first focus in the 1st phase



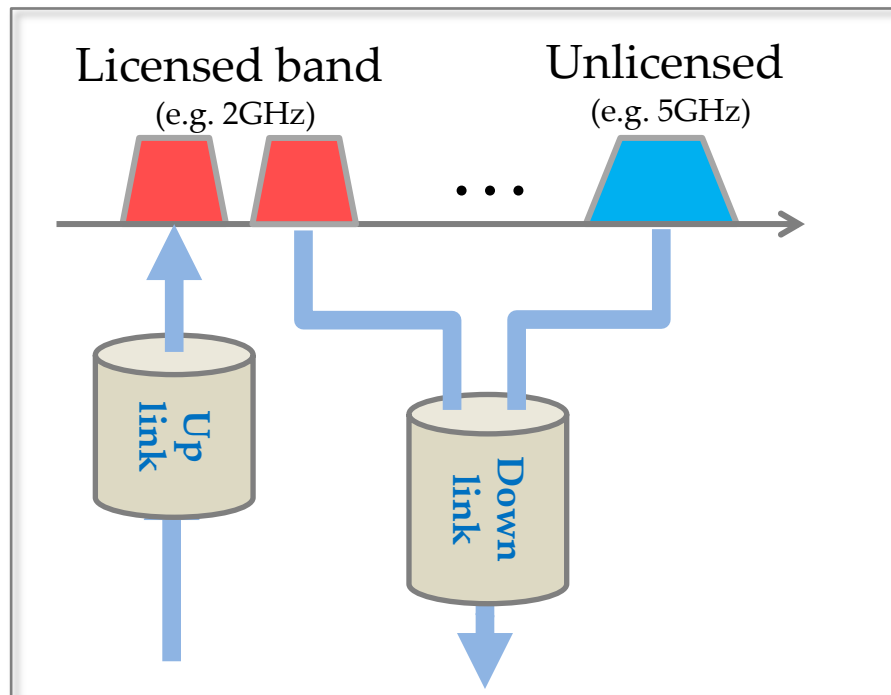
- Dual connectivity scenario may be considered in the 2nd phase if deemed necessary



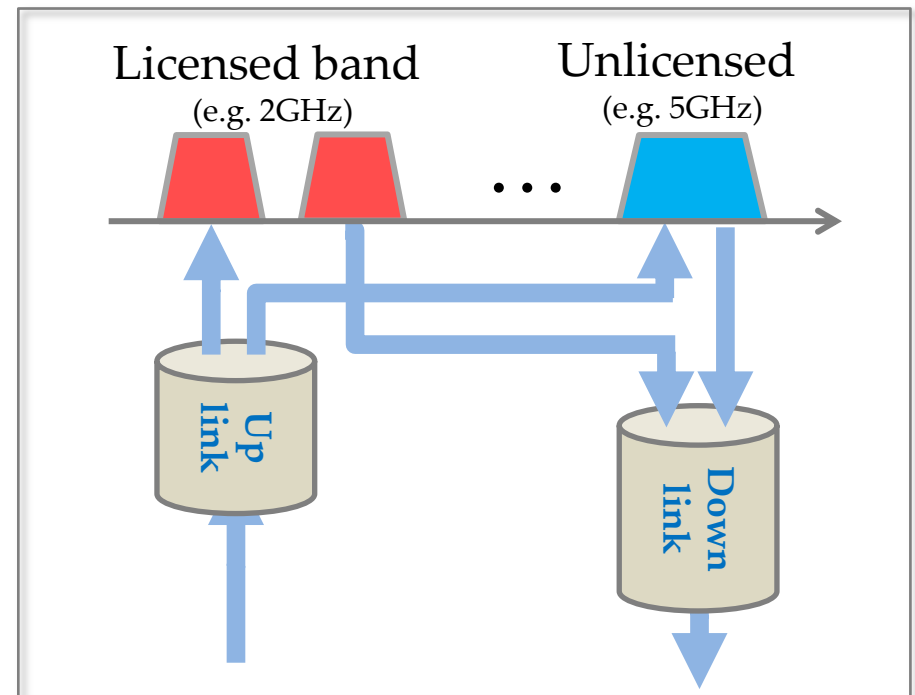
Deployments Scenario for LTE-U (2/2)

- Two approaches are now under consideration for carrier aggregation scenario with focus on supplemental downlink
 - For TDD only CA scenario, DL/UL on unlicensed spectrum can be considered.

Supplemental Downlink only



Both Downlink and Uplink



Frequency band for LTE-U

- Both 5GHz and other unlicensed spectrum should be considered as LTE-U spectrum due to the following reasons

5GHz spectrum may not be considered still as clean spectrum with low interference level in hot spot area by the time when LTE-U is deployed

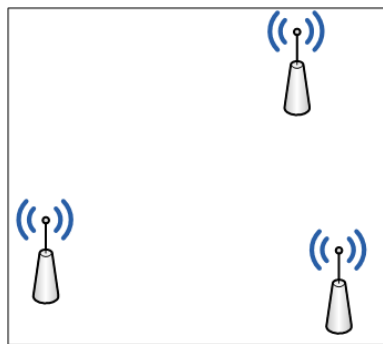
What spectrum is used for LTE-U is up to operators' business decision

LTE-U Co-existence (1/3)

➤ Co-existence with WiFi

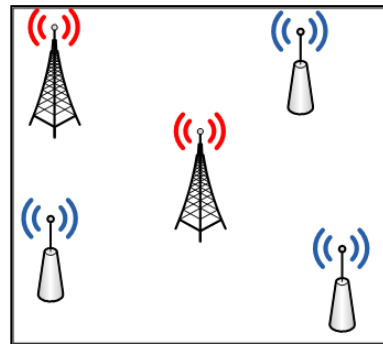
- Co-existence should lead to the mutual benefits eventually
- Relevant co-existence mechanisms similar as LBT (Listen Before Talk) should be studied and developed

➤ Performance comparison (when WiFi instead of LTE-U is deployed under all the same conditions)



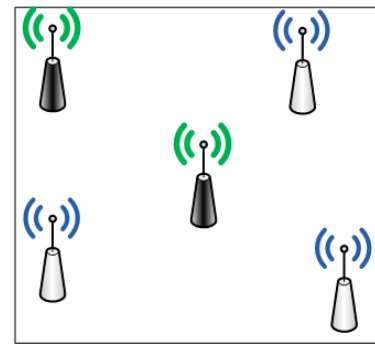
Scenario 1:

WiFi only



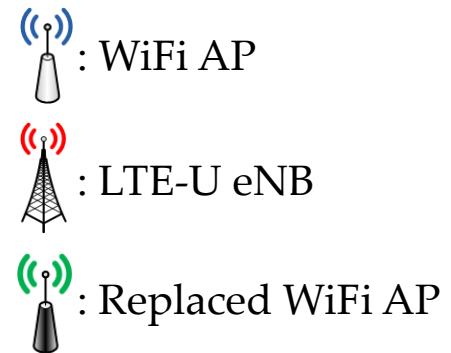
Scenario 2A:

LTE-U deployment
on top of Scenario 1



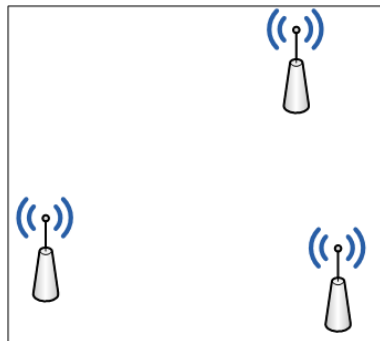
Scenario 2B:

WiFi deployment
on top of Scenario 1



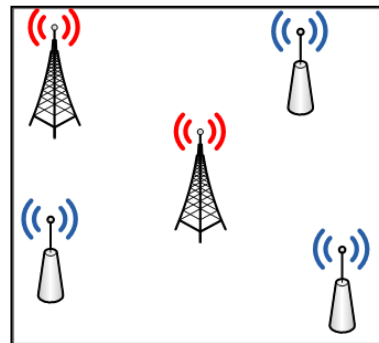
LTE-U Co-existence (2/3)

- **Performance metric for evaluation: Throughput gain and Fairness**
- **Throughput gain**
 - Gain of Scenario 2A compared to Scenario 2B
- **Fairness between LTE-U and WiFi can be estimated based on the followings**
 - Loss of WiFi APs' on Scenario 2A compared to Scenario 1
 - Loss of WiFi APs' on Scenario 2B compared to Scenario 1



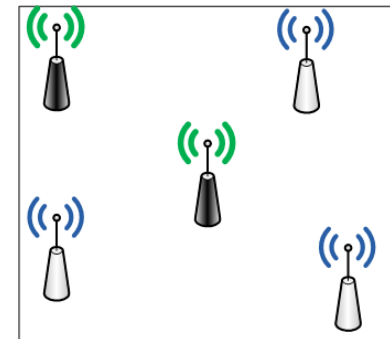
Scenario 1:

WiFi only



Scenario 2A:

LTE-U deployment
on top of Scenario1



Scenario 2B:

WiFi deployment on top
of Scenario 1

LTE-U Co-existence (3/3)

➤ Co-existence among different operators

- Deployment costs, flexibility and performance benefits should be the key parameters of decision on the following candidates

Carrier sensing based approach

Coordination among operators
(wired or wireless)

Mutual agreements on placement or
configuration of the nodes among operators

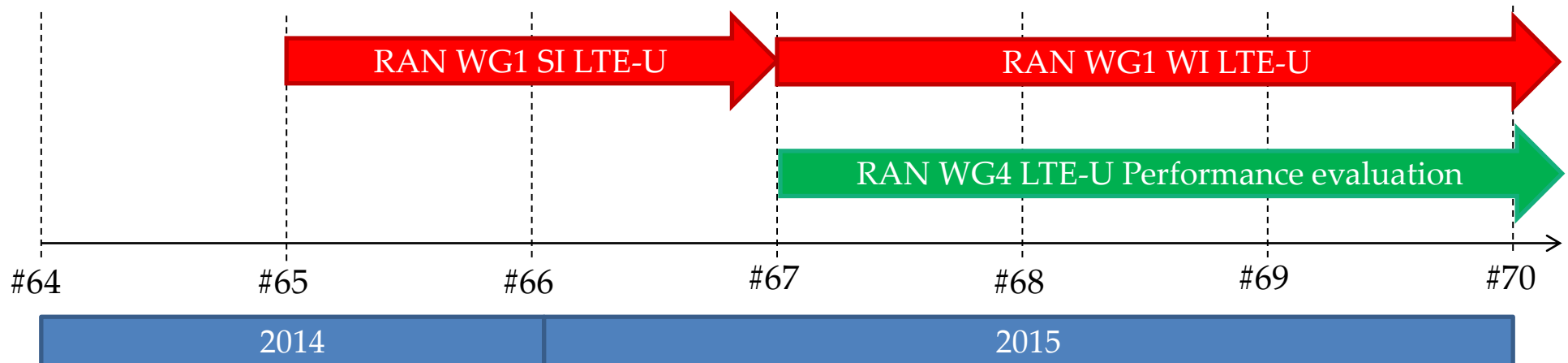
Time Plan

➤ Time plan of LTE-U standardization

- September 2014: Start of Rel-13 Study Item in RAN WG
- March 2015: Start of Rel-13 Work Item in RAG WG. RAN4 WI for performance evaluation.

➤ It should not jeopardize the proper completion of Release 12 specifications

- The following schedule may be shifted by 3 months if there's no room for new SI in September.



Conclusion

➤ LG's recommendations

Carrier aggregation scenario should be the first focus in the 1st phase

Both approaches of supplemental DL only and SCell (DL/UL) are now under consideration for carrier aggregation scenario with focus on supplemental downlink

Both 5GHz and other unlicensed spectrum should be considered as LTE-U spectrum

Proper co-existence mechanism such as LBT, CS should be studied, evaluated and developed

Co-existence mechanism among different operators should be considered and developed