Wireless Broadband Alliance

Driving next generation Wi-Fi experience

3GPP Programs for LTE in Unlicensed Spectrum

Market Drivers and Deployment Considerations

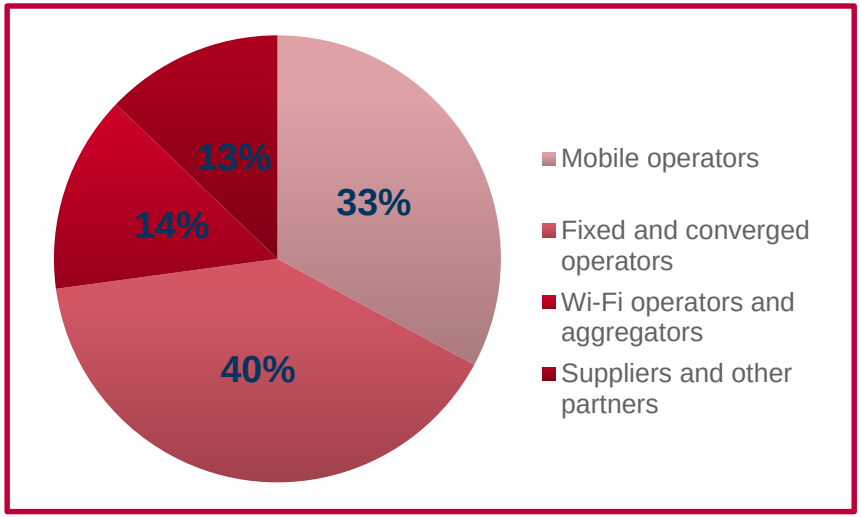
Intent and Goals

- Instead of focusing on LAA/Wi-Fi coexistence, which we feel other workshop attendees will address, the WBA would like to make a contribution focusing on the market drivers and deployment options for LTE Licensed Assisted Access and for LTE/WLAN Aggregation, and also consider how they relate to Carrier Wi-Fi services.

- The WBA has only recently undertaken this work as an official project, and the information shared today is preliminary in nature. A final report will be issued before the end of the year. We welcome other parties' contributions and input to this effort.

WBA Overview

Founded in 2003 by a unique mix of Mobile, Cable, Integrated and Wi-Fi Operators who viewed public Wi-Fi as a strategic complement to their mobile and fixed broadband network(s)



Members who registered for the Unlicensed LTE initiative

WBA retains a strong operator heritage from the various parts of the ecosystem – Thus, it is in privileged position to assemble a consensus-driven perspective on the Market and Deployment Drivers for LAA & LWA

+130 Members

WBA Work Areas

Accelerating the Ecosystem

Cooperation framework:

Joint taskforce:

Regular LS exchange:

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End-to-End Seamless Interoperability Across Operators

Carrier Grade Network Management

Auto Network Discovery & Selection

Global Roaming & Interoperability

Secure & Seamless Authentication

Programs & Projects

Main focus on:

- Carrier Wi-Fi
- Interoperability / Compliance
- Wi-Fi Roaming
- Wi-Fi Calling
- Unlicensed Technologies

The Success of Unlicensed Spectrum

- Wi-Fi has seen unprecedented success
  - Simple integration – over 10 Billion Wi-Fi enabled devices
  - Very low cost service due to open spectrum and economies of scale
  - Global adoption across virtually every wireless market segment
- Cellular industry is looking to unlicensed spectrum for added capacity to meet increasing customer demand for data services
  - 3GPP Release 12 and 13 Programs
  - Non-3GPP Proposals, such as LTE-U and MuLTEfire
  - 5G appears that it will involve licensed and unlicensed access
- Fair sharing of unlicensed spectrum is vital

Ref: WBA filing in response to the US FCC PN 15-105

Wi-Fi Economic Impact

In 2013, unlicensed spectrum generated USD 222 Billion in value to the U.S. economy and contributed USD 6.7 Billion to U.S. GDP. Public Wi-Fi Offloading generated a total economic surplus of USD 12.6 Billion and the benefits & savings associated with Wi-Fi enabled homes represent a total of USD 36 Billion

Source: Wi-Fi Forward, February 2014

The global Wi-Fi market, in terms of services and equipment, is estimated to be USD 14.8 Billion in 2015 and is projected to reach USD 33.6 Billion by 2020. The Compound Annual Growth Rate (CAGR) for the period from 2015 to 2020 is 17.8%.

Source: Markets & Markets, July 2015

- Note: "equipment" includes only infrastructure equipment

Related 3GPP Release 13 Work Items

- Licensed-Assisted Access to Unlicensed Spectrum, aka LTE Licensed-Assisted Access, aka LAA. (RP-151045)

- LTE-WLAN Radio Level Integration and Interworking Enhancement, aka LTE/WLAN Aggregation, aka LWA. (RP-151114)

  Further clarification of WBA's understanding of LWA:

  "LWA is a set of solutions that would provide aggregation at the radio level allowing for real time channel and local aware radio resource management across Wi-Fi and LTE using existing 802.11 technologies"

Market Drivers for LTE in Unlicensed Spectrum

- Increasing data throughput (capacity) via augmentation of the licensed LTE data path(s) with unlicensed path(s)
- No spectrum licensing expenses
- Minimizing Cap-Ex increase required
- Improving user mobility (coverage) while reducing/minimizing the core network signaling by integrating the unlicensed spectrum at the RAN Layer with standard LTE RAN/EPC interfaces
- Improving network based control of the terminal through “transparent” ability for operators to add/remove unlicensed capacity to the LTE data service.
- Seamless user experience when transitioning between Licensed-Only and Aggregated Licensed/Unlicensed operation

Specific Market Drivers – LAA and LWA

LAA	LWA
Utilize existing Carrier Aggregation (CA) solutions to aggregate licensed and unlicensed LTE paths	Utilize existing Dual Connectivity (DC) solutions to aggregate licensed LTE and unlicensed Wi-Fi paths
Potential of yielding higher performance than other licensed/unlicensed integration approaches based on use of LTE PHY/MAC in unlicensed (to be determined)*	Possibility for MNOs to partner with Fixed Wi-Fi Operators in non-co-located deployments (MNO – LTE RAN, Fixed Operator – Wi-Fi RAN)
Direct MNO management of unlicensed path(s) via LTE control mechanisms	Minimize impact (especially HW) on eNB, WLAN, and UE by leveraging existing technologies
	Perceived as more “coexistence friendly” to existing Wi-Fi services due to 802.11 transport

*Final determinations of spectral efficiency will depend upon the detailed LBT mechanisms specified, and should be compared to 802.11ac Wi-Fi.

Deployment Considerations for LTE in Unlicensed Spectrum

- Both LAA and LWA are only deployable by licensed spectrum holders – both require a licensed spectrum “anchor”
- Initial market focus appears to be on indoor deployments, as this is where the greatest demand for wireless data services exist
- These proposals seem to largely be linked to the deployment of licensed small cells, with the exception of LWA which would support Macro eNB integration with Wi-Fi small cells

Specific Deployment Considerations – LAA and LWA

LAA	LWA
LTE Small Cell eNB equipped with unlicensed LTE radio (new generation)	LTE Small Cell eNB equipped with unlicensed Wi-Fi radio (co-located, new generation)
	LTE Macro or Small Cell eNB interfaced with external WLAN (non-co-located, possibly existing WLAN generation)
Unlicensed Secondary Cell(s) would operate in 5 GHz spectrum subject to local regulatory limits	LWA Wi-Fi service could operate in either 2.4 GHz or 5 GHz or both subject to local regulatory limits
Only applicable to the MNO industry	Applicability to both MNO and Fixed Wi-Fi Operators
Unlicensed radio is provided by a specific mobile operator	In non-co-located mode, the unlicensed radio (WLAN) might support multiple MNOs' LWA services via separate SSIDs (neutral host deployment)
Will require new generations of UE HW supporting 5 GHz LTE radio (probably with concurrent support for 5 GHz Wi-Fi)	It may be possible that existing generations of UE HW could be updated via SW/FW to support LWA

Summary

WBA's work-in-progress will produce more in-depth information

- We welcome input from all the stakeholders over the coming weeks

Early analysis shows strong market drivers for LTE in unlicensed spectrum

- Some drivers are in common to both LAA and LWA
  - Increasing throughput/capacity without additional licensed spectrum expense
  - Seamless user experience on licensed and unlicensed spectrum
- Some aspects need more consideration; present tradeoffs
  - Enabling MNOs seamless integration with fixed Wi-Fi partners
  - Maintain MNO's ability to manage network
  - Balance the need of user input and preferences, operator policies and control;
  - Minimal impact on existing hardware (terminal, cellular network and WLAN)

Work together to ensure market forces and deployment considerations drive the technology

- WBA is open to considering a more formal relationship