IEEE P802.19
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| Proposed liaison to 3GPP related to LTE-U |
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Abstract

This document conatiins the proposd text of a liaison statement to 3GPP in relation to LTE-U

### IEEE 802 thanks 3GPP for recent liaison collaborations

IEEE 802 thanks 3GPP for its participation in recent liaison activities between the two organisations related to the work on LTE-U by 3GPP.

IEEE 802 particularly thanks Dino Flore, the Chairman of 3GPP RAN, for his presentation to IEEE 802.19 WG in January 2015. The presentation was very helpful in educating IEEE 802 participants about LTE-U’s progress in 3GPP and 3GPP’s plans for the future.

### IEEE 802 continues to be concerned about aspects of LTE-U

While the recent collaborations are encouraging, IEEE 802 is still concerned about many aspects of LTE-U. At a high level, IEEE 802’s concerns are similar to those expressed by Wi-Fi Alliance in their recent position statement on LTE-U.

IEEE 802 is particularly concerned that 3GPP is making decisions in a very short period of time that will affect billions of current and future users of 802.11 equipment without 3GPP attempting to achieve consensus with all important stakeholders, including the IEEE 802.11 WG and Wi-Fi Alliance.

The rest of this liaison statement justifies and articulates a variety of recommendations from IEEE 802 that may assist 3GPP mitigate various concerns of IEEE 802, and the Wi-Fi industry more generally.

### IEEE 802 recommends to 3GPP that they make a concerted effort to consider the views of all stakeholders

IEEE 802’s concern was highlighted by a response to a question from the 3GPP RAN Chair during his liaison presentation in January 2015 to the IEEE 802.19 WG in which he stated the only way to effect change to LTE-U in 3GPP was to gather support from a large number of 3GPP members, including a number of LTE operators.

This mechanism seems to discount the views of significant stakeholders, such as IEEE 802 participants, who do not traditionally participate in 3GPP and may be unfamiliar with its culture or processes.

**Recommendation**: *3GPP should formally include steps in their approval process for LTE-U that requires the views of important stakeholders, such as IEEE 802, to be resolved in a way that is satisfactory to all stakeholders*.

An alternative would be for 3GPP to not work with other stakeholders towards consensus. This would leave any stakeholders unhappy with 3GPP decisions with the less palatable option of working directly with legislators and regulators to ensure the best interests of the community are upheld.

**Undesirable alternative**: *3GPP could decide to* *leave any disagreement between 3GPP and other stakeholders to be resolved by legislators and regulators*.

### LTE-U Forum provides insights into LTE-U definition

Recently, the LTE-U Forum released documents that provided additional insight into the pre-standards LTE-U deployment plans of some vendors and service providers. The version of LTE-U documented by the LTE-U Forum has previously been called CSAT.

While these documents may or may not represent the views of 3GPP, a detailed review of these documents by IEEE 802 provides the basis of a series of recommendations from IEEE 802 that should be valuable to the standardisation process for LTE-U within 3GPP

### IEEE 802 recommends to 3GPP that LTE-U and 802.11 always have equal control for access to the medium

CSAT, as defined by the LTE-U Forum, allows the LTE-U system to statically or dynamically define the proportion of a cycle allocated to LTE-U operation and the proportion allocated to 802.11 or other systems. The power to make this decision gives LTE-U *control* over the unlicensed medium and potentially preference for LTE-U systems over 802.11 systems, which is clearly unacceptable for a community resource (unlicensed spectrum) that is supposed to be shared without preference.

**Recommendation**: *any sharing scheme must treat all LTE-U & 802.11 devices as “equals” in any decisions about medium access*

Of course, if such a preference for LTE-U operations over 802.11 operations is deemed acceptable then the unlicensed spectrum effectively becomes licensed spectrum in many respects. Control of licensed spectrum typically has significant value to the operator and the rest of the community needs to be compensated, typically by licensing fees. IEEE 802 does not view this approach as desirable because it risks the future ability of unlicensed spectrum to serve the needs of the broad community.

**Undesirable alternate**: *LTE-U operators must be charged license fees for controlling access to unlicensed spectrum*

### IEEE 802 recommends to 3GPP that ensure all LTE-U medium sharing algorithms are public, standardised and agreed

CSAT, as defined by the LTE-U Forum, allows the algorithms controlling access to the medium to be proprietary. This means that any imperfections in the algorithms or any biases toward LTE-U over 802.11 built into the system will be secret and thus unreviewable. This approach only increases the current distrust for the level of *control* that LTE-U systems could assert over 802.11 in terms of access to the unlicensed medium

**Recommendation**: *Any unlicensed medium sharing algorithms must be public, standardised and agreed by all relevant stakeholders*

### IEEE 802 recommends to 3GPP that ensure all LTE-U medium sharing algorithms respond quickly to changing conditions

CSAT, as defined by the LTE-U Forum, allows the sharing between LTE-U and 802.11 operations to be relatively static. This means that a sharing decision made in the past no longer represents reasonable sharing in the present, causing unfairness and inefficiency.

**Recommendation*:*** *Any unlicensed medium sharing algorithms must be designed to dynamically respond to the changing needs of all users*

Even when CSAT operates in a non-static mode, it appears that the sharing decisions are made based on an evaluation over a period of 100s ms, using a proprietary mechanism. In contrast, 802.11 systems are more reactive to changes in load and contention, adjusting on a packet by packet basis, based on a standardised mechanism.

**Recommendation*:*** *Any unlicensed medium sharing algorithms must be designed to respond to load changes within a few packet transmissions*

### IEEE 802 recommends to 3GPP that an agreement is reached on the definition of fairness or a mechanism that achieves fairness

The LTE-U Forum has proposed a test for the fairness of CSAT. One version of the test ensures that when a fully loaded LTE-U link and a fully loaded 802.11 link share the medium that the LTE-U link duty cycle is no more than 50%. This proposed test is a positive sign that the LTE-U Forum does intend to share the medium fairly with 802.11 systems.

However, the proposed test is somewhat simplistic in that it fails to test realistic user scenarios, including scenarios with both up and down link traffic. For example, suppose an LTE-U system with 10 clients and an 802.11 system with 10 clients shared the medium. Further suppose that the LTE-U traffic is downlink only and the 802.11 traffic is uplink only. Fair sharing principles, derived from what would happen if both systems were 802.11, means the LTE-U base station should have 1/11th of the bandwidth and the 802.11 clients should have 10/11th of the bandwidth. IEEE 802 is concerned that many 3GPP members might believe that fair access means the LTE-U base station should have half of the bandwidth and the 802.11 clients should have half of the bandwidth.

It is possible that the LTE-U Forum intend to expand their testing over time to cover more complex sharing use cases and their definition of fairness is aligned with IEEE 802 perspective. However, the simplicity of the current proposed tests highlights the lack of documented agreement on what fairness means in anything but the simplest cases.

**Recommendation**: *An agreement between all relevant stakeholders is needed on what fairness means in a range of realistic usage scenarios*

An alternative approach is to follow the historic approach of the Wi-Fi industry that avoids any need to agree on a definition of fairness, which is a complex undertaking. Instead, the Wi-Fi industry has agreed on an access method (CSMA/CA from 802.11) that is assumed by all to achieve fairness. In the context of LTE-U, this would mean that 3GPP and other stakeholders would need to agree on one or more access mechanisms that are agreed to be fair.

The benefit of this approach is that fast agreement is likely, especially if 3GPP adopts an access mechanism similar to 802.11, with LBT and some sort of exponential back off mechanism. Agreement on an LTE-U access mechanism by all stakeholders means it also might be possible for the LTE-U mechanism to be listed as an acceptable system in the ETSI BRAN standard in the same way 802.11 is currently listed.

**Desirable alternative**: *An agreement between all relevant stakeholders is needed on one or more acceptable access mechanisms*

### IEEE 802 recommends to 3GPP that simulations representing more realistic usage scenarios are completed before drawing any conclusions

The LTE-U Forum has also issued a technical report that documents a variety of simulations. They generally purport to show that LTE-U is “fair”, and that LTE-U even increases the performance of coexisting 802.11 networks. A recent demonstration of LTE-U by Qualcomm during a Fierce Wireless presentation made the same assertions.

These simulations have similar problems to many other simulations presented so far in 3GPP in that they address only simplistic use scenarios, whereas 802.11 systems are used in a much richer variety of use scenarios. In particular, these simulations typically:

* Consider limited traffic types
* Consider a relative low densities of devices
* Focus on low loads
* May compare older versions of 802.11 with non-public and as yet unspecified versions of LTE-U

IEEE 802 recognises that 3GPP do have plans to extend their simulations over time. However, it is worthwhile emphasising the importance of realistic simulations that represent how 802.11 systems are really used. Any conclusions about LTE-U/802.11 coexistence require the completion of these simulations and agreement on their validity.

**Recommendation**: *3GPP should ensure that realistic simulation scenarios with both uplink and downlink traffic are considered*

**Recommendation**: *3GPP should ensure that realistic simulation scenarios with a range of traffic types are considered*

**Recommendation**: *3GPP should ensure that realistic simulation scenarios with a range of device and load densities are considered*

Concerns have been expressed that the 802.11 system simulations are based on older implementations of 802.11. However, it is t is important to simulate LTE-U against simulations of the most recent implementations of 802.11.

**Recommendation**: *3GPP should ensure that any simulations represent the most modern 802.11 implementations*

### IEEE 802 recommends to 3GPP that it encourage participants to identify any reasonable scenarios in which LTE-U is not fair

Most of the simulations in 3GPP and by LTE-U Forum use simulation scenarios that are believed by the authors of the simulations to represent typical operation.

The problem with this approach is that there is a danger that the simulation scenarios will miss important use cases. This appears to be the case with many obvious high density, high load and uplink/down link use cases missing from the set of simulations.

On the other hand it is not possible to simulate all possible use cases and so an alternative method must be found to show that LTE-U does not “not work”. One method to resolve this conflict is to challenge all stakeholders to identify any reasonable use cases in which LTE-U is not fair.

*Recommendation: Submitters of simulation results should be encouraged by 3GPP to identify any reasonable use scenarios in which LTE-U is not “fair*