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Subject Liaison Statement to 3GPP RAN/RAN1/RAN4 related to PD & ED issues

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¹ This document solely represents the views of the IEEE 802 LMSC, and does not necessarily represent a position of the IEEE or the IEEE Standards Association.

Dear Chairmen of 3GPP RAN, RAN1 and RAN4,

This Liaison Statement from IEEE 802 deals with issues related to LAA's ED threshold and its effect on LAA/802.11 coexistence. These issues are documented as Issue 3 and Issue 13 in the most recent of a series of Liaison Statements exchanged between IEEE 802 and 3GPP RAN1 ([1], [2], [3], [4], [5]).

The main purpose of this Liaison Statement is to summarize our past discussions related to these issues and to progress those discussions towards a future resolution:

1. IEEE 802 & 3GPP RAN1 have continued to disagree on various issues related to LAA's ED threshold and its effect on LAA/802.11 coexistence
2. In the interest of resolving these outstanding issues, IEEE 802 requests that 3GPP continue to work with IEEE 802 to gather additional evidence relating to LAA/802.11 coexistence
3. IEEE 802 was encouraged by 3GPP's commitment to gather additional evidence by validating LAA/802.11 coexistence characteristics using test plans developed by 3GPP RAN4
4. IEEE 802 is now concerned that 3GPP may not undertake the promised LAA/802.11 coexistence tests before LAA's deployment
5. IEEE 802 therefore requests that 3GPP reconfirm its previous commitment to validate LAA/802.11 coexistence using tests developed in 3GPP RAN4 before LAA's deployment
6. IEEE 802 also requests that 3GPP clarify its plans for other testing of LAA's channel access mechanisms that may be relevant to LAA/802.11 coexistence
7. Alternatively, in the absence of availability of timely 3GPP RAN4 testing, IEEE 802 requests 3GPP provide its perspective on extending the Wi-Fi Alliance LTE-U tests to LAA.

More details related to each of the above high level points are included in the appendix of this Liaison Statement. The appendix also contains several explicit questions for which IEEE 802 requests responses from 3GPP.

IEEE 802 looks forward to a continued and productive interchange between our two organizations on these and other issues during the development of LAA and beyond. The next two IEEE 802 meetings are scheduled for 7-12 May 2017 in Daejeon, Korea and 9-14 July 2017 in Berlin, Germany.

Regards,

/s/ Paul Nikolich,

Chairman, IEEE 802 LAN/MAN Standards Executive Committee

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Appendix: Open issues related to ED threshold and coexistence between LAA and 802.11

1. IEEE 802 & 3GPP RAN1 have continued to disagree on various issues related to LAA's ED threshold and its effect on LAA/ 802.11 coexistence

IEEE 802 has expressed concerns in several Liaison Statements to 3GPP RAN1 over the last year or so that the use by LAA of an ED threshold of -72 dB, as currently defined in Release 13, will not result in fair coexistence between 802.11 and LAA systems. 3GPP RAN1 has generally disagreed with the concerns expressed by IEEE 802 and has declined to make suggested changes or undertake the additional investigations suggested by IEEE 802.

The following sub-sections summarise various Liaison Statements since March 2016 related to LAA's ED threshold in the context of LAA/802.11 coexistence.

1.1. March 2016: IEEE 802 suggested the use of either an ED threshold of -77 dBm or preambles to enhance LAA/ 802.11 coexistence

In a Liaison Statement to 3GPP RAN1 in March 2016 [1], IEEE 802 asserted that multiple simulation studies in 3GPP RAN1 during the LAA Study Item phase suggested that an ED threshold of -72 dBm for LAA is insufficient to support fair coexistence between 802.11 and LAA systems, particularly in common scenarios including weaker 802.11 links.

In the same liaison, IEEE 802 suggested that this issue could be resolved by LAA using an ED threshold of -77 dBm or by LAA detecting and acting on preambles transmitted by 802.11 systems at -82 dBm. In the latter case, this would allow LAA to use an increased ED threshold of -62 dBm. IEEE 802 noted that coexistence between LAA and 802.11 systems could be further enhanced by LAA systems also transmitting preambles that could be decoded by 802.11 systems, thus allowing 802.11 systems to more easily detect and defer to LAA systems.

1.2. May 2016: 3GPP RAN1 rejected IEEE 802's suggestions for use by LAA of a lower ED threshold or preambles and requested it adopt an ED threshold of -72 dBm for 802.11ax

In a Liaison Statement to IEEE 802 in May 2016 [2], 3GPP RAN1 responded to IEEE 802's Liaison Statement [1]. 3GPP RAN1 informed IEEE 802 that LAA's ED threshold was decided "*after considerable debate and with wide participation*". IEEE 802 notes that while there was participation in the debate by a diversity of stakeholders, there was not consensus from the IEEE 802 community. 3GPP RAN1 also asserted it was its opinion that, "*the agreed threshold levels will ensure fair coexistence as simulations based on the 3GPP indoor scenario have shown fair-coexistence when using the agreed CCA threshold*". The clear message from 3GPP RAN1 was that 3GPP RAN1 will not change the LAA ED threshold of -72 dBm despite the expressed concerns of IEEE 802.

On a more positive note, 3GPP RAN1 informed IEEE 802 that 3GPP RAN4 would develop multi-node coexistence tests to validate the 3GPP RAN1's coexistence claims. It was stated in the liaison that coexistence performance will be *"checked in cases where the detectable energy from IEEE 802.11 nodes is below the energy detection threshold. LAA equipment would be required to ensure fair coexistence via these test cases"*.

Finally, 3GPP RAN1 requested IEEE 802 to consider adopting an ED threshold of -72 dBm for 802.11ax, which is currently under development in IEEE 802.11 TGax, to align LAA and 802.11ax.

1.3. August 2016: IEEE 802 requested 3GPP RAN1 to change its simulation assumptions to better reflect realistic 802.11 deployments

In a Liaison Statement to 3GPP RAN1 in August 2016 [3], IEEE 802 expressed concern about the use of simulation models by 3GPP RAN1 that misrepresented typical indoor deployments of 802.11 systems. In particular, IEEE 802 requested 3GPP RAN1 consider fairness issues in configurations that have a *"larger percentage of weak 802.11 links than what is currently assumed in the 3GPP indoor model"*. IEEE 802 provided references to two 3GPP RAN1 documents that justified the inclusion of weak 802.11 links in any evaluations of coexistence between 802.11 and LAA systems.

1.4. November 2016: IEEE 802 rejected 3GPP RAN1's request that 802.11ax use an ED threshold of -72 dBm and requested it consider use of preambles in the Release 14

IEEE 802 did not respond immediately to 3GPP RAN1's May 2016 request [2] to consider adopting an ED threshold of -72 dBm for 802.11ax. However, IEEE 802 did respond to this request in a Liaison Statement to 3GPP RAN1 in November 2016 [4]. IEEE 802 declined 3GPP RAN1's request because it would put 802.11ax systems at a disadvantage compared to billions of existing and future 802.11a/n/ac systems using an ED threshold of -62 dBm and at a disadvantage to any LAA systems not detecting 802.11 preambles at -82 dBm.

In the same Liaison Statement, IEEE 802 requested that 3GPP RAN1 *"Consider explicitly defining support for PD-based channel access in a future release of LAA specification"*, recognising that 3GPP RAN1 had already rejected making any such change for Release 13 and it was probably too late for any change to Release 13 anyway.

1.5. November 2016: 3GPP rejected IEEE 802's request to consider the use of preambles in Release 14

In a Liaison Statement to IEEE 802 in November 2016 [5], 3GPP RAN1 provided its most recent response in the liaison exchange with IEEE 802.

3GPP RAN1 did not respond to IEEE 802's explanation of why 802.11ax adopting an ED threshold of -72 dBm is not appropriate, nor did it repeat its previous request that 802.11ax adopt an ED threshold of -72 dBm. On this basis, IEEE 802 considers this issue to be closed.

Instead, 3GPP RAN1 generally repeated other material from its previous Liaison Statements. In particular, 3GPP RAN1 noted that ED based coexistence using a level of -72 dBm was agreed in 3GPP RAN1 *“after considerable debate and with wide participation of stakeholders of both LAA and IEEE 802.11 technologies”*, and that the use of preamble detection had been considered and rejected.

On a more positive note, 3GPP RAN1 informed IEEE 802 that 3GPP RAN1 has defined a mechanism in LAA to allow a different ED threshold to be dynamically configured and that appropriate values will be studied in 3GPP RAN4. 3GPP RAN1 again noted that 3GPP RAN4 *“has decided on the development of a set of coexistence test cases including multi-node tests to verify the coexistence between LAA and IEEE 802.11 devices in various scenarios including testing above and below an ED threshold of -72 dBm for LAA devices”*. Finally, 3GPP RAN1 noted *“equipment would be tested to ensure fair coexistence between LAA and 802.11 systems”*.

2. In the interest of resolving these outstanding issues, IEEE 802 requests that 3GPP continue to work with IEEE 802 to gather additional evidence relating to LAA/802.11 coexistence

IEEE 802 greatly values our Liaison Statement exchanges with 3GPP RAN over the last few years. These exchanges have promoted better understanding by all stakeholders of likely LAA/802.11 coexistence characteristics, and have led to some important refinements in the LAA specification. They are also likely to influence aspects of the developing 802.11ax standard.

However, IEEE 802 notes that 3GPP RAN1 has declined to agree to IEEE 802’s suggestions to:

- Lower LAA’s ED threshold in either LAA Release 13 or LAA Release 14 based on evidence provided by IEEE 802
- Undertake additional LAA/802.11 coexistence investigations using more realistic deployment scenarios suggested by IEEE 802
- Adopt preamble detection or transmission as an LAA/802.11 coexistence mechanism as suggested by IEEE 802 based on its successful use in 802.11 over many years.

It is the view of IEEE 802 that multiple opportunities have been lost to enable the highest possible level of coexistence between LAA and 802.11 systems from the very earliest deployments of LAA. IEEE 802 requests that 3GPP continue to work with IEEE 802 to gather evidence before any LAA deployment on the best ways to promote fair coexistence between LAA and 802.11 systems, and to act on that evidence as it becomes available.

3. IEEE 802 was encouraged by 3GPP’s commitment to gather additional evidence by validating LAA/802.11 coexistence before LAA deployment using test plans developed by 3GPP RAN4

IEEE 802 was encouraged that 3GPP committed to validate its assertions about coexistence between LAA and 802.11 systems using tests being developed by 3GPP RAN4. IEEE 802 interprets this commitment by 3GPP to mean that LAA devices will be required to satisfy the coexistence tests developed by 3GPP RAN4 before their deployment.

IEEE 802 was particularly encouraged that 3GPP committed to testing deployment scenarios where 802.11 transmissions are received by LAA below the LAA ED threshold of -72dBm. This is important because such scenarios test configurations where weak 802.11 links operate below the LAA ED threshold in the presence of relatively stronger LAA transmitters, as is typical of many deployments in unlicensed spectrum.

IEEE 802 looks forward to reviewing the 3GPP RAN4's test plan proposals and the results of preliminary testing of LAA/802.11 coexistence. These results will provide valuable evidence for any potential changes to the LAA specification and the future IEEE 802.11ax standard.

4. IEEE 802 is now concerned that 3GPP may not undertake the promised LAA/802.11 coexistence tests before LAA's deployment

IEEE 802 has reviewed 3GPP reports documenting LAA/802.11 coexistence test development activities at the last three 3GPP RAN4 meetings: 10-14 October 2016 in Ljubljana, 14-18 November 2016 in Reno and 13-17 February 2017 in Athens. IEEE 802 notes that the coexistence tests are currently only about 30% complete [6] and there was little progress at the last 3GPP RAN4 meeting in Athens. There was almost no agreement ([7], [8]) on most details of any tests aligned with the commitment made in multiple Liaison Statements by 3GPP that the tests developed by 3GPP RAN4 will incorporate common 802.11 deployment scenarios in which 802.11 transmissions are received by LAA both above and below the LAA ED threshold of -72dBm.

IEEE 802 is concerned that any failure by 3GPP to develop the promised tests and then use them to validate the various LAA/802.11 coexistence claims before the deployment of LAA will result in an unacceptably high risk that LAA systems will adversely impact the operation of deployed 802.11 systems.

5. IEEE 802 therefore requests that 3GPP reconfirm its previous commitment to validate LAA/802.11 coexistence using tests developed in 3GPP RAN4 before LAA's deployment

IEEE 802 requests that 3GPP reconfirm its previous commitments that 3GPP RAN4 will develop and execute tests to validate LAA/802.11 coexistence prior to the deployment of LAA systems, especially in scenarios where 802.11 transmissions are received by LAA below the LAA ED threshold of -72dBm.

In addition, IEEE 802 requests that 3GPP provides answers to some related questions about the development and expected use of 3GPP RAN4's LAA/802.11 coexistence test plans:

- What is the expected date of completion of 3GPP RAN4's LAA/802.11 coexistence test plans?
- When are 3GPP RAN4's LAA/802.11 coexistence test plans expected to be executed with LAA systems?
- What is the expected process for reviewing the results of 3GPP RAN4's LAA/802.11 coexistence test plans?

- What is the expected process for making subsequent changes to the LAA specification in 3GPP RAN1?

6. IEEE 802 also requests that 3GPP clarify its plans for other testing of LAA's channel access mechanisms that may be relevant to LAA/802.11 coexistence

IEEE 802 notes that successful LAA/802.11 coexistence will depend on many aspects of the LAA channel access mechanisms operating as designed. After reviewing the 3GPP specifications TS 36.141 [9] and TS 36.104 [10], it is IEEE 802's understanding that there are only two tests currently documented related to LAA channel access:

- Test of adherence to the ED threshold of -72dBm with an error tolerance of 4dB, in a single 20MHz carrier configuration only
- Test of adherence to the TXOP limit of 8ms for Best Effort traffic (channel access priority class 3), in a single 20MHz carrier configuration only

If this is the case then IEEE 802 is concerned that the lack of functional tests for important aspects of LAA's channel access mechanisms will put LAA/802.11 coexistence at even greater risk. IEEE 802 requests that 3GPP clarify if these are the only functional tests currently documented and what plans there are for additional functional tests relevant to LAA/802.11 coexistence, such as tests for:

- Differentiated access for different access channel priority classes via appropriate selection and adaptation of channel access parameters
- Appropriate multiplexing of data of a lower access channel priority class in a COT obtained with the access parameters of a higher access channel priority class
- Multicarrier channel access

7. Alternatively, in the absence of availability of timely 3GPP RAN4 testing, IEEE 802 requests 3GPP provide its perspective on extending the Wi-Fi Alliance LTE-U tests to LAA

Alternatively, in the absence of any test defined by 3GPP RAN4 to test LAA/802.11 coexistence before the deployment of LAA, IEEE 802 requests that 3GPP provide its perspective on whether the Wi-Fi Alliance's LTE-U coexistence tests [11] might be extended to cover LAA?

References

- [1] [IEEE 802.19-16/0037r9](#), Liaison Statement to 3GPP from IEEE 802 LMSC, 18 March 2016
- [2] [3GPP R1-166040](#), Response LS to IEEE 802.11 regarding LAA, May 2016
- [3] [IEEE EC-16-0140-01-00EC](#), Review of 3GPP LAA Specification Rel. 13, 1 August 2016
- [4] [IEEE EC-16-0203-00-00EC](#), IEEE 802 LMSC response LS on energy detection threshold in future 802.11 technologies, 14 November 2016
- [5] [3GPP R1-1613770](#), Response LS to IEEE 802.11 regarding LAA, 14-18 November 2016
- [6] [3GPP RP-170301](#), Study on multi-node testing for LAA, Status Report to TSG, 3GPP TSG RAN meeting #75, Dubrovnik, Croatia, March 6-9, 2017
- [7] [3GPP R4-1702300](#), RAN4#82 Evening Adhoc Meeting report, 3GPP TSG-RAN WG4 Meeting #82, Athens, Greece, 13 - 17 February 2017
- [8] [3GPP RAN4#82 RF Chairman Notes](#), Athens, Greece, 13 - 17 February 2017
- [9] [3GPP TS 36.141 V14.2.0 \(2016-12\)](#), Base Station (BS) conformance testing
- [10] [3GPP TS 36.104 V14.2.0 \(2016-12\)](#), Base Station (BS) radio transmission and reception
- [11] [Wi-Fi Alliance Coexistence Test Plan](#), Version 1.0