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Wireless LANs

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| Proposed Liaison Statement to ETSI BRANin relation to *blocking energy* issues |
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Abstract

This document contains a proposed Liaison Statement from the IEEE 802.11 WG to ETSI BRAN related to blocking energy issues, particularly in the context of the next proposed revision of EN 301 893

**Liaison statement**

**TO:**

* Edgard Vangeel, ETSI BRAN Chair, evangeel@cisco.com

**CC:**

* Paul Nikolich, IEEE 802 Chair, paul.nikolich@att.net
* Andrew Myles, IEEE 802.11 Coexistence Standing Committee Chair, amyles@cisco.com

**SUBJECT:** *Blocking energy* and the revision of EN 301 893

**DATE:** 15 September 2017

Dear Edgard,

This document is an approved Liaison Statement from the IEEE 802.11 Working Group to ETSI BRAN. The positions contained within this Liaison Statement are those of the IEEE 802.11 Working Group and do not necessarily reflect positions of the IEEE, the IEEE Standards Association, IEEE 802 or any other IEEE organisational unit

The IEEE 802 Working Group wishes to liaise the following comments relating to the use of *blocking energy* in the 5 GHz band for ETSI BRAN’s consideration:

* The IEEE 802.11 standard is the basis the socio-economic success of Wi-Fi in Europe while remaining aligned with the Re-Directive
* The IEEE 802.11 Working Group is concerned that the use of *blocking energy* by other systems is contrary to the Re-Directive, and best practice
* The IEEE 802.11 Working Group requests that ETSI BRAN consider the its concerns related to the use of *blocking energy* in general by any systems
* The IEEE 802.11 Working Group has particular concerns relating to the use of *blocking energy* by 3GPP defined LAA based systems because it:
	+ Violates the fundamental definition of *radio equipment* in the RE-Directive
	+ Is contrary to requirements for *efficient use of radio spectrum* in the RE-Directive
	+ Is unnecessary for *good LAA performance*
	+ Is unnecessary given there are viable alternatives
* The IEEE 802.11 Working Group is pleased viable alternatives to *blocking energy* are being developed in 3GPP but is concerned they are insufficient and not mandatory
* The IEEE 802.11 Working Group recommends the *blocking energy* issue be resolved by placing restrictions on its use in a future revision of EN 301 893
1. The IEEE 802.11 standard is the basis of the socio-economic success of Wi-Fi in Europe while remaining aligned with the Re-Directive

The IEEE 802.11 standard has a long history (since 1997) of enabling efficient and fair access to unlicensed spectrum in shared environments in which control is distributed across multiple administrative domains. The standard has been the key to the socio-economic success of Wi-Fi in Europe, based around the concept that *anyone, anytime, anyplace can set up a wireless local area network that just works*.

In achieving this goal, IEEE 802.11 systems remain aligned with Article 3.2 of the RE-Directive (2014/53/EU), which states, *radio equipment shall be so constructed that it both effectively uses and supports the efficient use of radio spectrum in order to avoid harmful interference*.

The IEEE 802.11 PHY has developed over the years to incorporate the latest state of the art, thus supporting *effective* use of the radio spectrum. The IEEE 802.11 MAC mechanism has also been refined over the years. The latest version, EDCA, has proven excellent at *effectively* sharing the spectrum fairly with a diversity of users while avoiding *harmful interference* with other users.

1. The IEEE 802.11 Working Group is concerned that the use of *blocking energy* by other systems is contrary to the Re-Directive, and best practice

The IEEE 802.11 Working Group recognises that the mechanisms defined in the IEEE 802.11 standard are not the only way to satisfy the requirements of the RE-Directive. However, we are concerned that at least one mechanism being proposed for use in the 5GHz band in Europe will cause *harmful interference* to IEEE 802.11 and other systems and *spectrum inefficiency* by unnecessarily and unreasonably blocking access to the radio channel, contrary to the RE-Directive, and best practice.

In particular, at least one proposed system using a mechanism of concern transmits energy into a radio channel between the time access is allowed by the access method defined in EN 301 893 and the time the system is actually ready to transmit actual data. The primary goal of this transmitted energy is to block other systems from using the channel during this time interval. This mechanism has often been referred to as *blocking energy*.

1. The IEEE 802.11 Working Group requests that ETSI BRAN consider its concerns related to the use of *blocking energy* in general by any systems

The IEEE 802.11 Working Group requests that ETSI BRAN consider our concerns related to *blocking energy*, as documented in this Liaison Statement. Further, we request that ETSI BRAN consider adding requirements in the next revision of EN 301 893 that either ban the use of *blocking energy* or at least significantly restrict its use by any systems.

1. The IEEE 802.11 Working Group has particular concerns relating to the use of *blocking energy* by LAA based systems

The IEEE 802.11 Working Group’s concerns related to *blocking energy* are the result of ongoing discussions with 3GPP since late 2015 in relation to the LAA specification. We first raised our concerns related to *blocking energy* with 3GPP at the *3GPP LAA Workshop[[1]](#footnote-1)* in Beijing in August 2015. We subsequently expanded on our concerns in a series of Liaison Statements to 3GPP between March 2016 and March 2017[[2]](#footnote-2),[[3]](#footnote-3),[[4]](#footnote-4),[[5]](#footnote-5) We note that our concerns may also apply to eLAA, feLAA and NR, which are all also being specified by 3GPP, and MulteFire, which is being defined by the MulteFire Alliance.

In the case of LAA, we understand that the LAA specification uses an LBT mechanism to obtain authority to transmit in a channel, which is aligned with the requirements of EN 301 893. However, at the time authority to transit is obtained, the LAA device may not be ready to transmit, preferring to start transmission at a time synchronised with a partial or full sub-frame boundary (0.5ms or 1ms boundary). The LAA device then has a choice between two options.

In the first option, the LAA device may defer transmitting until the desired partial or full sub-frame boundary and then, after checking the medium is not busy, begin transmission. The problem of this approach, from LAA’s perspective, is that another device may have started transmission in the meantime, thus requiring the LAA device to postpone until the next boundary at which the medium is free. The LAA device is likely to be deferred multiple times in a busy environment. Even worse, if there in an independent LAA system operating the same channel, then it is almost guaranteed that the LAA’s systems will collide. This option is not particularly functional for LAA devices coexisting with Wi-Fi devices in a busy environment. In the case of multiple operating independent LAA systems, it will adversely affect all systems operating in the channel by causing additional collisions.

In the second option, the LAA device may transmit *blocking energy* into the medium to stop any other device gaining access to the medium during the time interval until the desired partial or full sub-frame boundary. The IEEE 802.11 Working Group objects to this approach because the use of *blocking energy*:

* Violates the fundamental definition of *radio equipment* in the RE-Directive
* Is contrary to requirements for *efficient use of radio spectrum* in the RE-Directive
* Is unnecessary for *good LAA performance*.
* Is unnecessary given there are viable alternatives.
	1. The use of *blocking energy* violates the fundamental definition of *radio equipment* in the RE-Directive

Any device transmitting energy for the purpose of blocking the transmission of another device does not even satisfy the most basic requirement for *radio equipment* in Article 2.1 of the RE-Directive, which states:

*‘radio equipment’ means an electrical or electronic product, which intentionally emits and/or receives radio waves for the purpose of radio communication …*

In particular, such a device is not attempting to communicate with another device using any conventional definition of communication.

It has been argued that the act of transmitting *blocking energy* is a form of communication that says “do not transmit”, based on the Energy Detection rules in EN 301 893. However, even if this is true, it is a very inefficient form of communications because it requires continuous transmission for potentially many milliseconds when only a tiny amount of actual information is being transmitted.

Such inefficient use of the spectrum is contrary to Article 3.2 of the RE-Directive because such inefficient use of the spectrum clearly causes *harmful interference* for other users of the channel:

*Radio equipment shall be so constructed that it both effectively uses and supports the efficient use of radio spectrum in order to avoid harmful interference*

In addition, it *obstructs* other systems *operating in accordance with the applicable international, Community or national regulations* contrary to the definition of *harmful interference* in Article 2.1 (7) of the RE-Directive:

*'harmful interference' means interference which endangers the functioning of a radio navigation service or of other safety services or which otherwise seriously degrades, obstructs or repeatedly interrupts a radiocommunications service operating in accordance with the applicable international, Community or national regulations;*

* 1. The use of *blocking energy* is contrary to requirements for *efficient use of radio spectrum* in the RE-Directive

The current version of EN 301 893 has no limits on the use of *blocking energy*, except that its length is restricted by rules relating to maximum transmission times. Technically this means, for example, that a device could transit *blocking energy* continuously for up to 6 ms when using Class 2 access parameters (as defined in EN 301 893). Assuming that the device used the minimum CW at all times, noting that the device would not have any reason to increase its CW given it was not communicating with another device, this would allow the device to block use of the channel for about 98% of the time. By any measure, this level of inefficiency would cause *harmful interference*.

LAA devices will not be as inefficient as this extreme example. Assuming a 4ms transmission of sub-frames and up to 1ms of *blocking energy*, LAA transmissions would be up to about 20% inefficient. However, even this level of inefficiency would cause *harmful interference* to other systems by denying them use of transmission time that is not being used by LAA devices for actual data.

It has been claimed that the *blocking energy* is analogous to a preamble and so is justified. The argument is that a preamble is a necessary component of a working communications system, and *blocking energy* is similarly a necessary part of an LAA system. However, *blocking energy* is only necessary in an LAA system to compensate for its poor design in attempting to force the synchronous LTE mechanism into an unlicensed spectrum that is more naturally asynchronous. In contrast, a preamble is a necessary part of all radio communications to allow the receiver to synchronise on the transmissions. Preambles are also required to be efficient.

* 1. The use of *blocking energy* is unnecessary for *good LAA performance*

According to 3GPP RAN1, the use of *blocking energy* by LAA is not even necessary. Indeed it is so unnecessary that its use is not even part of the LAA specification. In a Liaison Statement to IEEE 802 in May 2017[[6]](#footnote-6), 3GPP RAN1 stated:

*RAN1 again reiterates that the LAA specification does not specify the transmission of such signals and defines the eNB Cat 4 LBT procedure so that the eNB may explicitly avoid the transmission of such signals by defining a self-deferral procedure to enable channel access exactly at the medium boundary.*

This Liaison Statement was a reiteration of an earlier Liaison Statement to IEEE 802 in May 2016[[7]](#footnote-7), in which 3GPP RAN1 stated the non-use of *blocking energy* provided *good LAA performance* and is a *viable implementation option*:

*Based on the evaluation results in the study item phase, the LAA design, deferring sending energy until a subframe boundary or partial subframe boundary, satisfied the criteria that the presence of an LAA network doesn’t cause more degradation to 802.11 than the presence of another 802.11 network, and also provided good LAA performance, so it is considered a viable implementation option.*

The fact *blocking energy*’s use is accepted by 3GPP RAN1 as unnecessary for *good LAA performance* means any use of *blocking energy* must be very carefully justified by clear evidence that it does not cause *harmful interference*. For example, an appropriate level of evidence would be to show that another system is not significantly harmed by an LAA system using *blocking energy* compared to an LAA system not using *blocking energy*. It is insufficient to show that the use of *blocking energy* has a benefit to LAA. It is IEEE 802.11 Working Group’s understanding that no such evidence has been presented in any forum and believe that such evidence is unlikely to be found.

* 1. The use of *blocking energy* is unnecessary given there are viable alternatives

The unrestricted use of *blocking energy* is also unnecessary because there are viable alternatives. Indeed, 3GPP RAN has approved a work item to add new sub-frame starting positions. According to a Liaison Statement from 3GPP RAN1 to IEEE 802 in May 20173, these additional starting positions will enable *more efficient channel occupancy*,at least partiallyby limiting the duration of any *blocking energy*. The mere existence of this work item in 3GPP RAN1 is more clear recognition that the use of *blocking energy* is inefficient.

1. **The IEEE 802.11 Working Group is pleased viable alternatives to *blocking energy* are being developed in 3GPP but is concerned they are insufficient and not mandatory**

IEEE 802.11 Working Group believes that the specification of more starting positions is a positive development in limiting the use of *blocking energy*, as noted in a Liaison Statement to 3GPP RAN1 in March 20175:

*IEEE 802 now believes that this issue is heading towards consensus based on 3GPP RAN1’s efforts to minimize the time between the time a device obtains access to the channel and the next sub-frame*

However, the work item in 3GPP RAN1 defining the additional starting positions is insufficient to achieve the goals of the RE-Directive because:

* The new starting positions will only be available in LAA Release 15, which means Release 13 and Release 14 may use *blocking energy*
* There is no guarantee that the work item will result in many additional starting positions, which means *blocking energy* could still be often used
* The new starting positions may not be mandatory, noting the existing extra starting positions are only optional in LAA Release 13 and no decision will be made on what will be mandatory in Release 15 until after Release 15 is complete6, which means *blocking energy* could still be commonly and extensively used.
1. The IEEE 802.11 Working Group recommends the *blocking energy* issue be resolved by placing restrictions on its use in a future revision of EN 301 893

The IEEE 802.11 Working Group believes that the goals of the RE-Directive are best achieved by never allowing a device to transmit energy for the main purpose of blocking another device from using a channel. *Blocking energy* is a clear example of a transmission that is not *radio communications* (contrary to Article 2.1 of the RE-Directive) and that is obstructing other users (contrary to Article 3.2 of the RE-Directive).

Similar points were made in BRAN (16)111 in June 2016. This submission observed that the four reasons 3GPP asserted in support of allowing blocking energy in a number of Liaison Statements to IEEE 802, actually provided good evidence for banning the use of *blocking energy*.

However, in the interests of compromise, the IEEE 802.11 Working Group recommends that reasonable restrictions be placed on the use of *blocking energy* by all devices in the next revision of EN 301 893 rather than a complete ban, and that these restrictions be defined in a way that are applicable to all technologies. This approach will uphold the important principle of technology neutrality.

In particular, IEEE 802.11 Working Group recommends that, in the next revision of EN 301 893, a device only be allowed to transmit energy for a maximum of 100 µs when the primary purpose of that transmission is to block another user from accessing the channel.

In the context of LAA, this would mean that an LAA device would only be able to transmit *blocking energy* for a maximum of 100 µs before a starting position. Noting that an LAA symbol has a length of about 71 µs, this would allow LAA to operate with a starting position at each of the fourteen symbols in a sub-frame. While this different from how LAA currently operates today, a recent contribution to 3GPP RAN1[[8]](#footnote-8) suggests this is a feasible compromise solution to resolve the *blocking energy* issue.

The effect of such a rule would be to force LAA to define fourteen mandatory starting positions if 3GPP RAN1 decided that it is important to enable the use of blocking *energy*. Of course, 3GPP RAN1 could always decide not to enable the use of *blocking energy* because, as they noted previously, *deferring sending energy until a subframe boundary or partial subframe boundary … also provided good LAA performance.*

The IEEE 802.11 Working Group requests that ETSI BRAN consider our recommendation to restrict the use of blocking energy. We would be delighted to have further discussions with ETSI BRAN in relation to this topic.

Sincerely,

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Chair, IEEE 802.11 Working Group
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1. *IEEE 802 submission to 3GPP LAA Workshop on 29 August 2015 in Beijing, China*;
[mentor.ieee.org/802.19/dcn/15/19-15-0069-07-0000-ieee-802-submission-to-3gpp-laa-workshop.pptx](https://mentor.ieee.org/802.19/dcn/15/19-15-0069-07-0000-ieee-802-submission-to-3gpp-laa-workshop.pptx) [↑](#footnote-ref-1)
2. *Liaison Statement to 3GPP from IEEE 802 LMSC*, 18 March 2016;
[mentor.ieee.org/802.19/dcn/16/19-16-0037-09-0000-laa-comments.pdf](https://mentor.ieee.org/802.19/dcn/16/19-16-0037-09-0000-laa-comments.pdf) [↑](#footnote-ref-2)
3. *Review of 3GPP LAA Specification Rel. 13*, 21 May 2016; [grouper.ieee.org/groups/802/Communications/16\_05/802\_to\_3GPP\_22May\_2016\_Liaison\_r00.pdf](http://grouper.ieee.org/groups/802/Communications/16_05/802_to_3GPP_22May_2016_Liaison_r00.pdf) [↑](#footnote-ref-3)
4. *Review of 3GPP LAA Specification Rel. 13*, 1 August 2016; [grouper.ieee.org/groups/802/Communications/16\_08/802\_to\_3GPP\_01AUG\_2016\_Liaison\_r01.pdf](http://grouper.ieee.org/groups/802/Communications/16_08/802_to_3GPP_01AUG_2016_Liaison_r01.pdf) [↑](#footnote-ref-4)
5. *Liaison Statement to 3GPP RAN/RAN1: IEEE 802 response to 3GPP RAN1 LS dated November 2016 (R1-1613770)*, 22 March 2017; [mentor.ieee.org/802-ec/dcn/17/ec-17-0065-00-00EC-802-to-3gpp-ran-ran1-liaison-statement.pdf](https://mentor.ieee.org/802-ec/dcn/17/ec-17-0065-00-00EC-802-to-3gpp-ran-ran1-liaison-statement.pdf) [↑](#footnote-ref-5)
6. *Response LS to IEEE 802 regarding LAA*, May 2017; 3GPP R1-1709854 [↑](#footnote-ref-6)
7. *Response LS to IEEE 802.11 regarding LAA*, May 2016; 3GPP R1-166040 [↑](#footnote-ref-7)
8. *Design details of initial partial subframes for DL* LAA, August 2017, 3GPP R1-1713024 [↑](#footnote-ref-8)