IEEE P802.11
Wireless LANs

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| Followup liaison response to 3GPP R4-156870 |
| Date: 2014-07-17 |
| Author(s): |
| Name | Affiliation | Address | Phone | email |
| Laurent Cariou | Intel Corporation |  |  | Laurent.cariou@intel.com |
| Menzo Wentik | Qualcomm |  |  |  |
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Abstract

This document is a reply to the liaison from 3GPP RAN R4-156870.

The 3rd Generation Partnership Project (3GPP) had submitted a letter to the IEEE 802.11 Working Group (WG). The letter is documented in IEEE 802.11-15/1263r0.

# Summary of the letter from 3GPP

**1. Overall Description:**

In order to allow WLAN-LTE radio level Integration and interworking measurement reporting events are being specified in 3GPP specifications. It has also been agreed that IEEE 802.11 Beacon RSSI measurement will be used as triggering quantity for these WLAN measurement reporting events.

In order to define the corresponding measurement reporting requirements in Rel-13, RAN4 needs to specify the physical layer (L1) measurement period over which the accuracy of “IEEE 802.11 Beacon RSSI measurement” is to be met. Hitherto only IEEE 802.11 Beacon RSSI measurement accuracy requirement is defined in 3GPP TS 36.133, Rel-12. The accuracy is the same as defined in the IEEE 802.11 specification.

RAN4 proposes a tentative L1 measurement period of 5 seconds for the Beacon RSSI measurement.

RAN4 kindly requests IEEE 802.11 WG and Wi-Fi Alliance to provide their feedback on the Beacon RSSI L1 measurement period (i.e. 5 seconds) proposed by RAN4. If the proposed value of 5 seconds is not considered feasible then IEEE 802.11 WG and Wi-Fi Alliance are requested to provide suitable performance figure.

**2. Actions:**

**To IEEE 802.11 and WiFi Alliance:**

**ACTION:** RAN4 kindly requests IEEE 802.11 WG and Wi-Fi Alliance to provide feedback on the L1 measurement period (i.e. 5 seconds) for the IEEE 802.11 Beacon RSSI measurement proposed by RAN4 or if this is not feasible then kindly propose suitable performance figure.

# Summary of this reply letter

IEEE 802.11 Task Group mc developed this reply letter for approval by the IEEE 802.11 Working Group.

To: 3GPP TSG-RAN WG4 c/o Muhammad Kazmi@ericsson.com

CC: WiFi Alliance, RAN2

Subject: Response to LS on WLAN Measurement Requirements

Date: 2015-xx-xx

Dear Muhammad,

We would like to thank 3GPP TSG-RAN Working Group (WG) 4 for its letter requesting the following from the IEEE 802.11 WG:

“RAN4 kindly requests IEEE 802.11 WG and Wi-Fi Alliance to provide feedback on the L1 measurement period (i.e. 5 seconds) for the IEEE 802.11 Beacon RSSI measurement proposed by RAN4 or if this is not feasible then kindly propose suitable performance figure.”

Based on your explanations, we understand that:

* The 802.11 Beacon RSSI measurement can be requested for the serving AP or for neighbor APs. For neighbor APs, the request can be for a single AP, with or without information on the operating channel and SSID. It can also be for multiple APs without any information on operating channels, which requires a full scan.
* this L1 measurement is a requirement for maximum delay, which means that the UE can report 802.11 beacon RSSI measurements to the network as soon as it receives it, but no longer than the L1 measurement period.
* The measurement requests require different levels of response and aging time limits:
	+ Periodic measurements of serving APs are used for flow control when LWA is active and not in deep sleep. Those measurements can be time-sensitive. We call this category: measurements of serving AP.
	+ Measurements for mobility roaming decisions are expected to be non-periodic and to be done for a single neighbor AP with known operating channel information. Those measurements are time-sensitive. We call this category: Measurement of known single neighbor AP
	+ Measurements on all channels can be used to identify candidate neighbor APs, when no information on operating channels is provided. Those measurements are non-time-sensitive. We call this category: Measurement of multiple unknown neighbor APs

For measurements of the serving AP, the measurement time can be very small as the beacons are received and decoded every beacon interval.

When being asked to process RSSI measurements for neighbor APs, the delay can be much longer. The Wi-Fi device may be used for other active connections, i.e. connection to an infrastructure AP, P2P, Mobile AP, NAN,…. The RSSI measurements must therefore be done while minimizing the impact on existing traffic QoS and on battery life, which creates further delay for measurements on channels different from the one used by the serving AP.

To minimize such delays, most Wi-Fi devices would attempt to shorten out of channel time by utilizing active scan, when permitted, based on sending probe requests and identifying APs and their RSSI on probe responses. Because of DFS, indoor and SRD rules in the 5GHz band, active scanning is not always possible. Under such circumstances, RSSI measurements have to be performed through passive scanning with beacon reception, usually sent with a periodicity of 100ms. Some devices improve the RSSI estimation by averaging the results obtained with the reception of multiple beacons.Unlike cellular network, WLAN is designed for stationary, nomadic or pedestrian usages, and not expected to support UE moving in driving speeds. Therefore design targets for channel variation rate is expected to be lower than these for cellular network. UE devices and their connectivity management SW are therefore using smart channel assessment and multi-sensor motion indications to control dynamically periodic scan interval (to collect Beacon RSSI measurements for WiFi network selection), in order to target the best tradeoff between battery life, time to detect network, signal quality and impact on QoS. Typically, scanning algorithms are subject to proprietary optimizations.

As RSSI measurements for LTE-WLAN aggregation/interworking might also be periodic, it is advised to avoid having two asynchronous periodic scan cycles due to the impact described above. Therefore, we would like to propose that LTE-WLAN aggregation/interworking RSSI measurement requests would allow reporting of cached scan results if available, with a limitation on aging time of 30s assuming static environment.

Based on all these elements, we believe that the maximum scan times and aging limits could be as follows:

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|  | Typical max refresh time |
| Measurement of Serving AP | 0.5 sec |
| Measurement of known single neighbor AP/SSID on a single channel | 5 sec |
| Measurement of multiple unknown neighbor APs | 30 sec |

These times are based on a beacon interval in the order of 100ms. Networks with a beacon interval that substantially exceeds 100ms have a lower probability of being detected during a typical passive scan.

A response will be transmitted immediately when recent cached information is available, and no longer than the indicated time when a new scan is required, but without guarantee that all channels will have been scanned within that time.

Sincerely,

Adrian Stephens
IEEE 802.11 Working Group Chair

**References:**

1. 11-14-0936-03-000m-liaison-response-followup-to-3gpp-tsg-ran-wg2.doc