IEEE P802.11
Wireless LANs

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| Comments on Sensing SG Proposed CSD |
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Abstract

This document contains editorial and technical modifications and comments on the sensing SG’s proposed CSD as presented in section 1.2 of document IEEE 802.11-19-2105r0.

All modifications are done with review mode switched on with respect to the original document. Comments are added whenever necessary for explanation.

## 1.2 5C requirements

### 1.2.1 Broad Market Potential

Each proposed IEEE 802 LMSC standard shall have broad market potential. At a minimum, address the following areas:

a) Broad sets of applicability.

According to the research in [1], the global estimation of Wi-Fi economy will increase from $1.96 trillion to $3.46 trillion. And as of 2018, there are more than 340,846,887 Wi-Fi hotspots worldwide. Status of Wi-Fi market above can pave a broad way for WLAN sensing applications since the adoption of many applications are hindered by expensive dedicated sensing hardware, such as indoor localization sensors, home security and motion sensor systems etc.

There are several market drivers for WLAN sensing, including:

* According to the report released by MarketandMarkets, the indoor positioning market is expected to grow from $7.1 billion in 2017 to $41.0 billion by 2022, at a Compound Annual Growth Rate (CAGR) of 42.0% during the forecast period [2]. Radio Frequency (RF)-based technology is also proposed as a key solution in this report.
* According to another report [3], the global market for home security system market was valued at $40.66 billion in 2017 and is expected to reach $74.75 billion by 2023, at a CAGR of 10.40% during the forecast period. Additionally, the report points out that the growth of the market can be attributed to the emergence of wireless technologies, and increasing customer awareness.
* According to another report [4], gesture recognition and touchless sensing market worth $34.25 billion by 2022 where the touchless sensing market including gesture-enabled products, such as smartphone, laptops, tablets, and smart TVs etc., is expected to be worth $15.27 billion by 2022, growing at a CAGR of 17.44% between 2017 and 2022.
* According to the MarketandMarkets.com in their latest report [5], the smart home market including lighting controls, home healthcare, entertainment and other controls is expected to grow from $76.6 billion in 2018 to $151.4 billion by 2024, at a CAGR of 12.02%.

b) Multiple vendors and numerous users.

A wide variety of vendors currently build numerous products for WLAN sensing marketplace. According to the same reports above [2-5], many of the current players in the sensing applications market are also vendors for the WLAN sensing and thus it is anticipated that a substantial proportion of those vendors, and others, will participate in subsequent commercialization activities for WLAN sensing.

### 1.2.2 Compatibility

Each proposed IEEE 802 LMSC standard should be in conformance with IEEE Std 802, IEEE 802.1AC, and IEEE 802.1Q. If any variances in conformance emerge, they shall be thoroughly disclosed and reviewed with IEEE 802.1 WG prior to submitting a PAR to the Sponsor.

1. Will the proposed standard comply with IEEE Std 802, IEEE Std 802.1AC and IEEE Std 802.1Q?

YES

1. If the answer to a) is no, supply the response from the IEEE 802.1 WG.

The review and response is not required if the proposed standard is an amendment or revision to an existing standard for which it has been previously determined that compliance with the above IEEE 802 standards is not possible. In this case, the CSD statement shall state that this is the case.

### 1.2.3 Distinct Identity

Each proposed IEEE 802 LMSC standard shall provide evidence of a distinct identity. Identify standards and standards projects with similar scopes and for each one describe why the proposed project is substantially different.

This amendment defines modifications to the IEEE 802.11 medium access control layer (MAC), to the physical layers (PHY) of High Throughput (HT), Very High Throughput (VHT), and Directional Multi Gigabit (DMG), and to PHYs under concurrent development (specifically, High Efficiency WLAN (HEW), Next Generation 60 GHz (NG60), and Extremely High Throughput (EHT)), including enhancements introduced in IEEE P802.11az defined in the Next Generation Positioning (NGP) ammendment, that enhance Wireless Local Area Network (WLAN) sensing (SENS) operation in the 2.4 GHz/5 GHz/6 GHz bands and in license-exempt bands frequency bands between 1 GHz and 7.125 GHz and above 45 GHz.

### 1.2.4 Technical Feasibility

Each proposed IEEE 802 LMSC standard shall provide evidence that the project is technically feasible within the time frame of the project. At a minimum, address the following items to demonstrate technical feasibility:

a) Demonstrated system feasibility.

Thereare already some WLAN based sensing products available in the market. The WLAN sensing project is focusing on improving the performance of WLAN sensing capabilities.

The IEEE 802.11 WNG and SENS TIG/SG has reviewed many presentations indicating that the proposed enhancements are technically feasible. For example, please refer to [6-17] which list improvements related to efficiency, security, and accuracy to enhance current use case and enable new ones etc.

b) Proven similar technology via testing, modeling, simulation, etc.

IEEE Std. 802.11 technology is very mature and has a wide variety of legacy devices and a proven track record, with several billions of devices shipping each year. The increased capabilities envisioned for the baseband and RF parts necessary to implement the proposed amendment are in line with the current progress in technology and not expected to impinge testability.

The amendment will use modeling and simulation, based on real world deployment, as a tool for evaluating performance metrics.

### 1.2.5 Economic Feasibility

Each proposed IEEE 802 LMSC standard shall provide evidence of economic feasibility. Demonstrate, as far as can reasonably be estimated, the economic feasibility of the proposed project for its intended applications. Among the areas that may be addressed in the cost for performance analysis are the following:

a) Balanced costs (infrastructure versus attached stations).

WLAN equipment is accepted as having balanced costs. The development of features to support sensing capabilities of WLAN network deployments will not disrupt the established balance.

b) Known cost factors.

Support of the proposed standard will likely require a manufacturer to develop a modified radio, modem and firmware. The cost factors for these transitions are well known and the data for this is well understood.

c) Consideration of installation costs.

The proposed amendment has no known impact on installation costs.

d) Consideration of operational costs (e.g., energy consumption).

There are billions of WLAN systems in operation around the world. WLAN systems are recognized to provide a total cost of ownership (TCO) that provides a significant operation cost benefits. This amendment is not expected to change today’s operation costs.

e) Other areas, as appropriate.

None.

**References:**

[1] The Economic Value of Wi-Fi: A Global View (2018 and 2023), October 2018

[2] Indoor Location Market by Component, Deployment Mode, Application, Vertical, and Region - Global Forecast to 2022, [Indoor Location Market by Technology, Software Tools, Service Global Forecast to - 2022 | MarketsandMarkets](https://www.marketsandmarkets.com/Market-Reports/indoor-location-market-989.html)

[3] Home Security System Market by Home Type, <https://www.marketsandmarkets.com/Market-Reports/home-security-system-market-205573901.html>

[4] Gesture Recognition and Touchless Sensing Market, <https://www.marketsandmarkets.com/Market-Reports/touchless-sensing-gesturing-market-369.html>

[5] The smart home market, <https://www.marketsandmarkets.com/Market-Reports/smart-homes-and-assisted-living-advanced-technologie-and-global-market-121.html>

[6] <https://mentor.ieee.org/802.11/dcn/19/11-19-1293-00-0wng-wi-fi-sensing-usages-requirements-technical-feasibility-and-standards-gaps.pptx>

[7] <https://mentor.ieee.org/802.11/dcn/19/11-19-1500-00-0wng-wi-fi-sensing-follow-up.pptx>

[8] <https://mentor.ieee.org/802.11/dcn/19/11-19-1416-00-0wng-wi-fi-sensing-cooperation-and-standard-support.pptx>

[9] <https://mentor.ieee.org/802.11/dcn/19/11-19-1551-01-0wng-wi-fi-sensing-in-60ghz-band.pptx>

[10] <https://mentor.ieee.org/802.11/dcn/19/11-19-1745-00-SENS-wireless-sensing-use-cases-feasibility-and-standardization.pptx>

[11] <https://mentor.ieee.org/802.11/dcn/19/11-19-1726-00-SENS-discussion-of-market-potential-and-technical-feasibility-about-wlan-sensing.pptx>

[12] <https://mentor.ieee.org/802.11/dcn/19/11-19-1769-01-SENS-csi-based-wi-fi-sensing-results-and-standardization-challenges.pptx>

[13] <https://mentor.ieee.org/802.11/dcn/19/11-19-1850-00-SENS-wi-fi-sensing-technical-feasibility-standardization-gaps.pptx>

[14] <https://mentor.ieee.org/802.11/dcn/19/11-19-1852-00-SENS-in-car-sensing-a-60ghz-usage-example.pptx>

[15] <https://mentor.ieee.org/802.11/dcn/19/11-19-1854-00-SENS-wlan-based-radars-in-the-60ghz-band.pptx>

[16] <https://mentor.ieee.org/802.11/dcn/19/11-19-1885-00-SENS-passive-radar-a-potential-solution-for-wlan-sensing.pptx>

[17] <https://mentor.ieee.org/802.11/dcn/19/11-19-1886-00-SENS-indoor-sensing-with-fmcw-radar.pptx>

[18] <https://mentor.ieee.org/802.11/dcn/19/11-19-1897-00-SENS-wi-fi-sensing-with-doppler-measurement-in-60ghz-band.pptx>