IEEE P802.11
Wireless LANs

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| IEEE 802.11 NGP SG Proposed CSD |
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Abstract

This is the IEEE 802.11 Next Generation Positioing (NGP) SG proposed CSD.

# 1. IEEE 802 criteria for standards development (CSD)

The CSD documents an agreement between the WG and the Sponsor that provides a description of the project and the Sponsor's requirements more detailed than required in the PAR. The CSD consists of the project process requirements, 1.1, and the 5C requirements, 1.2.

## 1.1 Project process requirements

### 1.1.1 Managed objects

Describe the plan for developing a definition of managed objects. The plan shall specify one of the following:

1. The definitions will be part of this project. **YES**
2. The definitions will be part of a different project and provide the plan for that project or anticipated future project.
3. The definitions will not be developed and explain why such definitions are not needed.

### 1.1.2 Coexistence

A WG proposing a wireless project shall demonstrate coexistence through the preparation of a Coexistence Assurance (CA) document unless it is not applicable.

1. Will the WG create a CA document as part of the WG balloting process as described in Clause 13? **YES**
2. If not, explain why the CA document is not applicable.

## 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 ABI market forecast1 the number of Indoor Location installations is expected to rise from 10B in 2014 to 80B by 2018, this increase will be required to support the expansion of various market segments of accurate positioning:

* Indoor location revenues for in-store analytics from tens of millions USD in 2014 to more than 1.8B USD by 2018.
* Hyperlocal coupons and offers and scans expected to rise from tens of millions USD in 2014 to almost 1.5B USD by 2018.
* Mobile search market expected to rise from a few millions in 2014 to roughly 1B USD in 2018.

According to another market forecast2 within the mobile device segment the year over year market till 2018 for 802.11 based positioning technology is expected to grow by roughly 15% for AP to STA usages with peer to peer usages to grow by 50% year over year for the same period.

The enhancements of the proposed amendment are set to fortify and better place 802.11 based technology to be able to support this.

b) Multiple vendors and numerous users.

A wide variety of vendors currently build numerous products for the Wireless Local Area Network (WLAN) marketplace. According to ABI research the market size for indoor location is expected to increase by a factor of ten compared to 2013 while the number of devices to increase by a factor of eight. According to ABI Research3 many of the current players of indoor location market are also vendors of WLAN segement and thus it is anticipated that a substantial proportion of those vendors, and others, will participate in the standards development process and subsequent commercialization activities.

## 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**
2. 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 project will focus on a WLAN that can efficiently support positioning services beyond those offered by the Fine Timing Measurement (FTM) protocol specified in P802.11 IEEE P802.11 (known as REVmc) for High Throughput (HT), Very High Throughput (VHT), Directional Multi Gigabit (DMG) and PHYs under concurrent development (e.g., High Efficiency (HE), Next Generation 60GHz (NG60)) STAs. This project shall enable determination of absolute and relative position with better accuracy with respect to FTM executing on the same PHY-type, This project shall optimize system level performance attributes like wireless medium usage, power consumption and scalability to dense deployments.

There is no other WLAN standard focusing on expanding the available positioning services and significantly improving existing positioning service scalability and performance other than this amendment.

This amendment will differentiate itself from other IEEE 802 wireless standards via the title which highlights the scope as positioning enhancements.

## 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.

802.11 based devices implementing the Fine Timing Measurement (FTM) procedure standardized as part of IEEE P802.11 (known as REVmc) already exist12. In Line of Sight (LoS) environments these devices are capable of estimating their position accurately. However in Non-Line of Sight (NLoS) environments, the accuracy is degraded. It is expected that the positioning mechanisms developed as part of this amendment will use information available in existing 802.11 frames or augment it with additional information, in order to estimate a more accurate position even in NLoS environments.

A number of submissions6,7,8,9,10,11 have been made to Wireless Next Generation (WNG) and to IEEE P802.11 (known as REVmc) outlining techniques to improve accuracy in NLoS environments; enhance scalability in dense deployments; and reduce power consumption and wireless medium usage. Some of them are included in the References section of this document. These submissions demonstrate that it is feasible to improve performace of the positioning protocol and accomplish the goals of this project.

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

IEEE 802.11 is a mature technology which 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 impact testability.

**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).

1. WLAN equipment is accepted as having balanced costs. The development of Wireless capabilities to enhance the positioning services offered by of WLAN network deployments and improve system level performance will not disrupt the established balance.
2. b) Known cost factors.

Support of the proposed standard will likely require a manufacturer to develop a modified radio, modem and firmware. This is similar in principle to the changes required to support FTM for HT and VHT and DMG STAs developed under IEEE P802.11 (known as REVmc). 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.

This amendment is targeting to maintain (or reduce) power consumed by devices executing the positioning protocol, as specified in the PAR.

e) Other areas, as appropriate.

None.

**References:**

1. \*1 INDOOR LOCATION IN RETAIL: WHERE IS THE MONEY? by ABI research March 2013.
2. \*2 SMARTPHONE INDOOR LOCATION TECHNOLOGIES by ABI research June 2013.
3. \*3 Indoor Location Positioning Technology: Research, Start-ups and Predictions by Grizzly Analytics market Research March 2013.
4. \*4 INDOOR LOCATION TECHNOLOGY OEMS Dec. 2013
5. \*5 11-13-0072-01-000m-client-positioning-using-timing-measurements-between-access-points by Erik Lindskog, Naveen Kakani et-al.
6. 11-14-1235/r0 – Scalable Location by Brian Hart, Peter Thornycroft and Mark Rison.
7. 11-12-1249-04-000m-802-11-2012-cid-46-47-48 by Carlos Aldana et-al.
8. 11-15-1464-02-0wng-NG Positioning Overview and Challenges by Jonathan Segev
9. 11-14-1263-00-0wng-direct-finding-positioning-for-802-11 by James Wang
10. 11-14-1235-00-0wng-scalable-location by Brian Hart
11. 11-11-1033-00-00ah-location by Russ Markovsky
12. Next Generation Indoor Positioning System Based on WiFi Time of Flight,by Leor Banin, Uri Schatzberg, Yuval Amizur presented at the 26th International Technical Meeting of the Satellite Division of The Institute of Navigation, Nashville TN, September 16-20, 2013