

**IEEE P802.15**  
**Wireless Personal Area Networks**

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Project	IEEE P802.15 Working Group for Wireless Personal Area Networks (WPANs)	
Title	Positive Train Control Five Criteria	
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Re:		
Abstract	[Five Criteria for the SG PTC.]	
Purpose	[Working document for the 5 Criteria to the P802.15 PTC Group]	
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## Five Criteria – IEEE 802.15.4 Positive Train Control, Amendment to 802.15.4 current revision

### 1. BROAD MARKET POTENTIAL

#### a) Broad sets of applicability.

Positive Train Control (PTC) systems are intended to: prevent train-to-train collisions; enforce train speed restrictions; provide safety for road and rail workers; and prevent movement through misaligned switches.

Development of an amendment to IEEE 802.15.4 for use in systems intended to address United States (US) federally mandated PTC will have immediate applicability on interoperable systems that must begin to be in operation by end of 2015. As well, the establishment of an 802.15.4 PTC amendment may be of use in existing and future communications based train control (CBTC) systems, and may encourage use of other existing IEEE 802.15 standards for low data rate command and control applications, expanded monitoring and control, and information exchange systems for transportation uses.

#### b) Multiple vendors and numerous users.

The number of participants and the breadth of participation in the PTC Study and Interest Groups demonstrate the level of interest in this class of networks. Participants include US Federal agencies (including DOT, FRA, FTA), foreign government rail agencies, systems integrators, equipment manufacturers, silicon manufacturers, transportation engineering consultancies, academic researchers, telecommunications service providers, and rail and transit system operators.

Potential users include: passenger rail entities, freight rail entities; state, regional, municipal and private rail transit entities; US regulatory and government agencies; and spectrum licensees and spectrum management entities. Potential vendors include existing IEEE 802.15.4 device and component vendors, system integrators as well as new companies entering the space.

#### c) Balanced costs (LAN versus attached stations).

Based upon the known costs of existing and planned IEEE 802.15.4-compliant devices, it is expected that the proposed amendment can be developed with the aim that the connectivity costs will be reasonably small as compared to the cost of devices or the value of the applications served.

### 2. COMPATIBILITY

**IEEE 802 defines a family of standards. All standards shall be in conformance with the IEEE 802.1 Architecture, Management, and Interworking documents as follows: 802 Overview and Architecture, 802.1D, 802.1Q, and parts of 802.1f. If any variances in conformance emerge, they shall be thoroughly disclosed and reviewed with 802.1.**

**Each standard in the IEEE 802 family of standards shall include a definition of managed objects which are compatible with systems management standards.**

This standard will be compatible with the IEEE 802 requirements of Architecture, Management, and Inter-networking documents as required. There is no specific technology feature anticipated in the standard that could preclude this compliance.

Managed objects will be defined, if needed, consistent with existing policies and practices for IEEE 802 standards.

### 3. DISTINCT IDENTITY

**a) Substantially different from other IEEE 802 standards.**

There are no other IEEE 802 wireless projects specifically addressing narrow channel width, high reliability operation in high-mobility (600 km/h) information exchange, sensor, and command & control applications.

**b) One unique solution per problem (not two solutions to a problem).**

The proposed amendment will add to the existing 802.15.4 standard the ability to operate and meet performance requirements in high mobility environments, and to operate in bands not considered in the current standard. Consequently, this is the only optimized solution to this particular problem.

**c) Easy for the document reader to select the relevant specification.**

The proposed standard will produce a clearly distinguishable amendment to the IEEE 802.15.4 specification.

### 4. TECHNICAL FEASIBILITY

**a) Demonstrated system feasibility.**

Existing train communications and control protocols (including Incremental Train Control System (ITCS), Advanced Civil Speed Enforcement System (ACSES), and Electronic Train Management System (ETMS) have been implemented and are operational. Testing in the 220 MHz band is ongoing at the American Association of Railroads (AAR) Transportation Technology Center (TTC). Operation of Incremental Train Control System (ITCS) at 220 MHz in the Michigan Department of Transportation/Amtrak corridor has been authorized to 160 km/h (100 mph). Operations in 44 MHz spectrum for ETMS and Hyrail Limits Compliance System (HLCS) have demonstrated some aspects of the required functionality, at speeds up to 50 mph (80km/h). Advanced Train Control Systems (ATCS) have been in operation for upwards of 20 years in the 160-161 MHz band and the 896-897/935-936 MHz paired band. In Europe, GSM-R (GSM for Railroad) has been designed for speeds up to 500 km/h and is tested and proven to 350 km/h in revenue service.

**b) Proven technology, reasonable testing.**

The technologies and uses mentioned in the previous paragraph demonstrate that a standards-based system can be designed and fabricated.

**c) Confidence in reliability.**

The proposed functionality will be designed to meet relevant reliability standards.

**d) Coexistence of IEEE 802 LMSC wireless standards specifying devices for unlicensed operation.**

The WG will create a Coexistence Assurance document as part of the WG balloting process.

### 5. ECONOMIC FEASIBILITY

**a) Known cost factors, reliable data.**

As the proposed amendment is largely the addition of a new frequency band, there are existing IEEE 802.15.4-class devices that operate near these frequencies. These devices are manufactured in large volume and these volumes are expected to increase dramatically as other industries, including Smart Utility Networks, begin to scale up.

**b) Reasonable cost for performance.**

Based on existing systems deployed for rail communications applications, and upon similar devices being deployed today for systems like Smart Utility Networks, it is expected that the wireless connectivity components will meet the expected cost, size and power requirements.

**c) Consideration of installation costs.**

Devices compliant to a future IEEE 802.15.4 PTC specification are intended to reduce operator installation and maintenance costs through improved equipment availability and interoperability.