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TECHNICAL SPECIFICATION

**Wireless Industrial Applications (WIA);
Radio equipment to be used in the 5,725 GHz to 5,875 GHz
frequency range with power level up to 400 mW;
Methods and concepts for a WIA system approach
to sharing in the 5,725 GHz to 5,875 GHz band**

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Foreword

This Technical Specification (TS) has been produced by ETSI Technical Committee Electromagnetic compatibility and Radio spectrum Matters (ERM).

Modal verbs terminology

In the present document "**shall**", "**shall not**", "**should**", "**should not**", "**may**", "**need not**", "**will**", "**will not**", "**can**" and "**cannot**" are to be interpreted as described in clause 3.2 of the [ETSI Drafting Rules](#) (Verbal forms for the expression of provisions).

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Introduction

The present document describes radio aspects related to the central coordination point (CCP) concept. The intended application domain is wireless industrial applications (WIA) within the 5,8 GHz WIA band.

The concept of a central coordination point (CCP) is a mechanism which allows the coordination of multiple devices and/or multiple networks using single or multiple spectrum access technologies with the intension of optimizing spectrum efficiency and ensuring coexistence. The objective of the CCP as described in the present document, is to establish an automated adaptive coexistence management for the 5,8 GHz WIA band, which means that the CCP identifies and manages the available spectrum for WIA under its control. The CCP employs mitigation techniques like Dynamic Frequency Selection (DFS) and Detect and Avoid (DAA) in order to protect incumbent services or applications.

NOTE: The term device is used in the present document as a synonym for equipment.

The technical specifications of higher layer protocol mechanisms that are needed to allow a multi-vendor-capable-CCP are not part of the present document.

1 Scope

The present document describes methods and concepts for a Central Coordination Point (CCP) in order to support spectrum sharing between WIA devices with power level up to 400 mW and other systems operating in the 5,725 GHz to 5,875 GHz band, i.e. the 5,8 GHz WIA band. The present document covers two aspects:

- CCP for sharing with incumbent services/applications (e.g. those identified in ECC Report 206 [i.1]).
- CCP for Intra-system coexistence.

2 References

2.1 Normative references

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the referenced document (including any amendments) applies.

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NOTE: While any hyperlinks included in this clause were valid at the time of publication, ETSI cannot guarantee their long term validity.

The following referenced documents are not necessary for the application of the present document but they assist the user with regard to a particular subject area.

- [i.1] ECC Report 206: "Compatibility studies in the band 5725-5875 MHz between SRD equipment for wireless industrial applications and other systems".
- [i.2] Gnad, A.; Krätzig, M.; Schade, J.; Schönrock, R.; Trikaliotis, S.; Rauchhaupt, L.: "Software Defined Radio und Cognitive Radio in der industriellen Automation. Deutsche Forschungsgesellschaft für Automation und Mikroelektronik (DFAM), ISBN: 978-3-8163-0614-6, VDMA Verlag, Frankfurt(Main), 2011".
- [i.3] CENELEC EN 62591 (2010): "Industrial communication networks - Wireless communication network and communication profiles - WirelessHART™".
- [i.4] CENELEC EN 62734 (2015): "Industrial networks - Wireless communication network and communication profiles - ISA 100.11a".
- [i.5] CENELEC EN 62657-2 (2015): "Industrial communication networks - Wireless Communication networks - Part 2: Coexistence management".
- [i.6] CENELEC EN 61158-1:2014: "Industrial communication networks - Fieldbus specifications - Part 1: Overview and guidance for the IEC 61158 and IEC 61784 series".

[i.7] CENELEC EN 61918:2013: "Industrial communication networks - Installation of communication networks in industrial premises".

3 Definitions, symbols and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions given in CENELEC EN 62657-2 [i.5] and the following apply:

5,8 GHz WIA band: Wireless Industrial Automation (WIA) assigned total frequency range of 5 725 MHz to 5 875 MHz

Central Coordination Point (CCP): device coordinating resources in the different wireless systems/networks

coexistence (wireless communication coexistence): state in which all wireless communication solutions of a plant using shared medium fulfil all their application communication requirements

frequency range: range of operating frequencies over which the equipment can be adjusted

harmful interference: interference which endangers the functioning of a radionavigation service or of other safety services or which otherwise seriously degrades, obstructs or repeatedly interrupts a radiocommunications service operating in accordance with the applicable Community or national regulations

network: all of the media, connectors, repeaters, routers, gateways and associated node communication elements by which a given set of communicating devices are interconnected

NOTE: The definition is the same as in CENELEC EN 61158-1:2014, 3.1.30 [i.6].

node: end-point of a branch in a network

NOTE: The definition is the same as in CENELEC EN 61918:2013, 3.1.50 [i.7].

radio equipment: an electrical or electronic product, which intentionally emits and/or receives radio waves for the purpose of radio communication and/or radiodetermination, or an electrical or electronic product which is always completed with an accessory, such as antenna, so as to intentionally emit and/or receive radio waves for the purpose of radio communication and/or radiodetermination

radio communication: communication by means of radio waves

radiodetermination: determination of the position, velocity and/or other characteristics of an object, or the obtaining of information relating to those parameters, by means of the propagation properties of radio waves

radio waves: electromagnetic waves of frequencies lower than 3 000 GHz, propagated in space without artificial guide

3.2 Symbols

For the purposes of the present document, the following symbols apply:

dBm	dB relative to 1 milliwatt
GHz	Gigahertz
Hz	Hertz
kHz	kilohertz
MHz	Megahertz
W	Watt

3.3 Abbreviations

For the purposes of the present document, the following abbreviations apply:

AARM	Automation Application Resource Management
AFA	Adaptive Frequency Agility
BFWA	Broadband Fixed Wireless Access
CCP	Central Coordination Point
CCW	CCP Controlled WIA
DAA	Detect And Avoid
DFS	Dynamic Frequency Selection
EIRP	Effective Isotropic Radiated Power
FSS	Fixed Satellite Services
ISDB	Incumbent Service/Application Database
ITS	Intelligent Transport System
LRDB	Local Industrial Environment Resource Database
RF	Radio Frequency
RLAN	Radio Local Access Network
RRM	Radio system and device Registration and Management
SM	Spectrum Manager
SRE	Spectrum Resource Engine
SSU	Spectrum Sensing Unit
TTT	Transport and Traffic Telematics
WIA	Wireless Industrial Application

4 Concept of Central Coordination Point

4.1 Overview

The idea of a central coordination point (CCP) is to coordinate between multiple devices and/or multiple wireless networks using single wireless communication solution or multiple wireless communication solutions. The aim is to further improve the use of spectrum. The main idea is that a central device should coordinate the use of spectrum by these devices and/or networks with respect to bandwidth, time and space for multiple devices and/or networks, instead of using mitigation techniques individually per radio device.

In general, the functional architecture for radio systems with CCP shall fulfil the following basic requirements:

- Support of spectrum coordination mechanisms to provide coexistence between different systems and services in the same frequency range, with the aim of:
 - Protection of incumbent radio systems (e.g. Radiolocation, BFWA, ITS).
 - Avoidance of harmful interferences.
- Support of mechanisms for automatically spectrum allocation and spectrum access, with the aim of:
 - Recognition of free and occupied spectrum.
 - Detection and classification of incumbent radio systems and services.
- Support mechanisms for continuous surveillance of the frequency spectrum condition.

The resources can be selected in time, in frequency and in space domain. The CCP can organize the available spectrum resources and assign resource blocks to the different wireless networks or devices within the 5,8 GHz WIA band.

The CCP shall communicate with network access points or with individual wireless devices by means of one or more communication channels and protocols. Therefore, the CCP shall fulfil the following requirements:

- Support of different radio technologies.
- Support of interface for interoperability.
- Support of interface for coordination.

Two scenarios can be considered:

- 1) CCP for sharing with other incumbent services/applications. This scenario is described in clause 4.2.
- 2) CCP for intra-system coexistence. This scenario is described in clause 4.3.

The CCP for intra-system coexistence can substitute manual coexistence management as defined by CENELEC EN 62657-2 [i.5].

The CCP is scheduling resources to the different wireless systems. This can include CCP to single device communications or CCP to network access point communication. In the latter case, the network access point will then use the CCP information to configure and control its own wireless network.

If WIA systems are not controlled by a CCP and operate independently using their own spectrum access mechanisms, then there is no coordination between the WIA systems, and they rely on their own techniques for network formation, network discovery, service discovery and interference management, including the protection of incumbent services.

4.2 CCP concept for sharing with other incumbent services and applications operating within the 5,8 GHz band

4.2.1 General

A CCP concept for sharing with other incumbent services and applications is intended to take away the burden of implementing the needed mitigation techniques for the used spectrum in each device. Another benefit of this concept is that the CCP can sense the incumbent services at the edges of the installed area with a better receiver sensitivity as the WIA devices can perform it; this behaviour is also required in the ECC Report 206 [i.1].

If the available spectrum not used by incumbent services is identified by the CCP, then the CCP shall calculate the most efficient spectrum assignments that can be assigned to the CCP controlled systems and CCP controlled devices based on their WIA requirements on communication needs.

WIA systems in a factory environment may operate exclusively over one or more network access technologies and many of these WIA systems may be capable of operating simultaneously in a factory environment. For example CCP controlled WIA systems and incumbent services/applications within the 5,8 GHz WIA band, such as radiolocation, transportation system and BFWA are depicted in Figure 1.

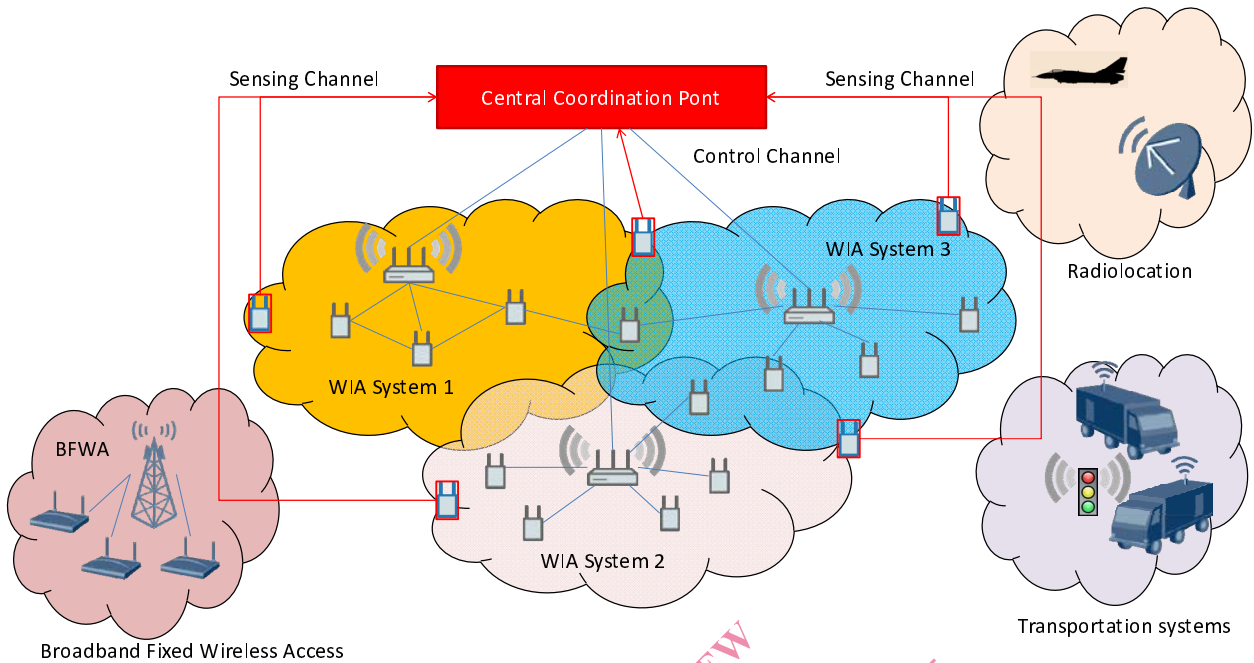


Figure 1: CCP controlled WIA systems and incumbent services and applications

Figure 2 shows the incumbent services and applications using the 5,8 GHz WIA band. The incumbent services and applications with a high regulatory involvement are the following: radiolocation, fixed satellite services (FSS), transportation systems like Transport and Traffic Telematics (TTT), ITS non-safety and broadband fixed wireless access (BFWA).

Table 1 shows typical parameters for some incumbent services and applications in the 5,8 GHz WIA band as defined in ECC Report 206 [i.1].

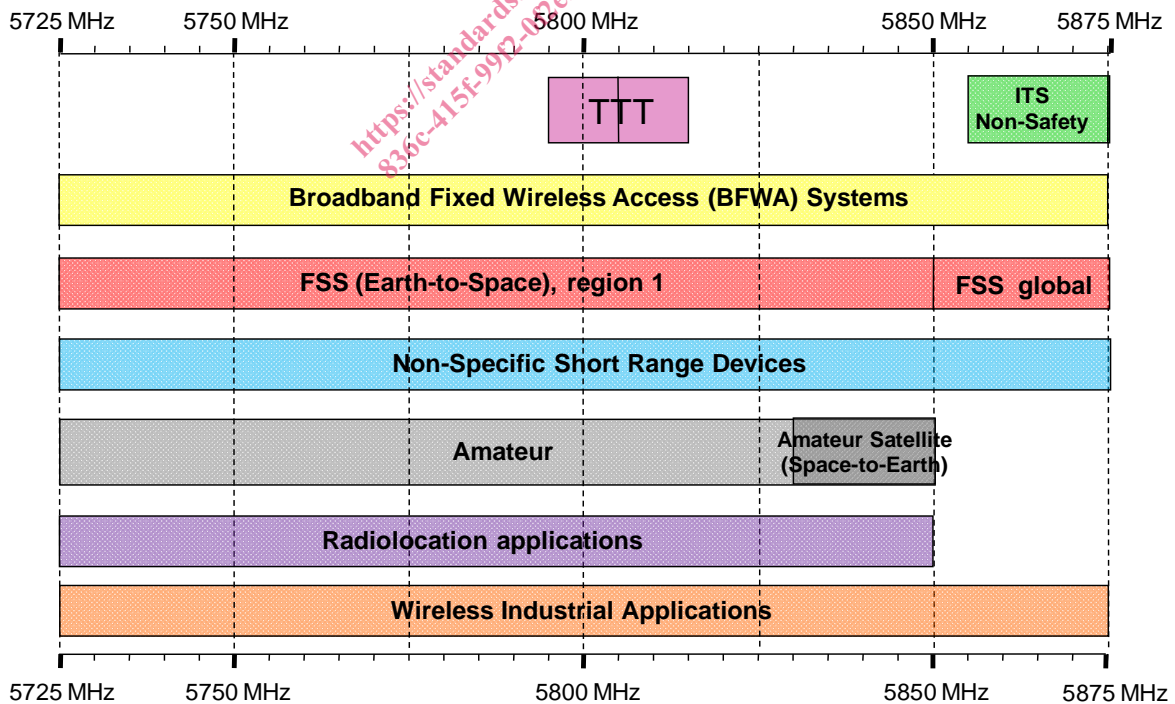


Figure 2: Overview of incumbent service/applications