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Sustainable mobility and transportation — Framework for transportation services by providing meshes for 5G communication

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ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Email: copyright@iso.org
Website: www.iso.org

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 268, *Sustainable cities and communities*, Subcommittee SC 2, *Sustainable cities and communities - Sustainable mobility and transportation*.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

5G is the latest generation of cellular mobile communication services, connecting multiple terminals and devices such as PCs and smartphones. Non-electronic objects can also be involved in 5G communication, when they are electronically recognized using methods such as QR-codes and face recognition by converting their images into electronic data. Thus, no matter whether things are digitally processed/processable or not, all items can be connected in 5G communication, which is characterized by high speed, negligible delay and large capacity traffic in data transmission, assisted with edge computing.

In 5G communication, carrier waves in high-frequency ranges are used, where many frequency channels had been vacant. However, high frequency waves are easily scattered by objects while propagating. This shortcoming requires building many base stations to successfully receive and forward waves.

Transportation services are the most widely networked to connect people, delivery items and freight to villages, towns, cities and large city zones with public roads, railroads and rivers or canals which have transportation facilities, i.e. streetlamps, traffic signals, signboards, bus stops, railroad instruments, stations, ports. Private and commercial vehicles are active wherever human activities are in place. Transportation facilities and vehicles are, therefore, operative places to install nodes with a transceiver for carrier waves. The facilities and vehicles statically or dynamically form local ad hoc networks of meshes which can organically be overlapped with backbone networks of 5G communication. This complements the current transportation services using 5G communication services, indirectly and effectively.

This document outlines how transportation facilities and vehicles can contribute to transportation services using 5G communication services by providing as many large and stable meshes as possible, as a means to support the current 5G backbone networks.

In the development of this document, ISO Guide 82 has been taken into account in addressing sustainability issues.

Sustainable mobility and transportation — Framework for transportation services by providing meshes for 5G communication

1 Scope

This document provides:

— a framework for transportation services using 5G communication by providing meshes;

— a description on expanding the service coverage of 5G backbone networks for transportation and mobility by applying meshes created in transportation facilities, vehicles and service dispatches;

— a service framework using infrastructure, vehicles and mobility service providers;

— a description on the effective transportation service for sustainable cities and communities.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

No terms and definitions are listed in this document.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

4 Concept of framework for transportation services by providing meshes for 5G communication

4.1 Background

5G communication services are starting to become widespread worldwide to transmit more data by increasing the number of carrier wave channels. Since 3G and 4G communication mainly uses low frequency channels, most countries use high frequency ranges to adopt 5G communication by following 3GPP TS 38.104 V16.7.0. The frequency ranges used for 5G communication, which are normally 3,5 GHz to 3,8 GHz, are higher compared to those for 3G and 4G communication. Owing to the short wavelengths of the carrier waves in 5G communication, the waves can be easily scattered while propagating and drastically attenuating. To gain wave signal amplitude or power for longer distance transmission and expand the service coverage, more base stations should be built up, but they require sufficient power supply and large premises for operation, which results in increased capital costs. As the service areas remain limited due to such reasons, 5G communication has not yet become common worldwide.

As transportation systems already have dense and large networks, it is expected that transportation infrastructures can be used as places to install small cells for mesh networking to enlarge 5G communication coverage. Small cells, the size and weight of which are minimized, can be simply placed at as many spots as possible to locally process communication signals. Such a small cell, called a mesh