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Öffentlicher Verkehr - Interoperables Fahrgeldmanagement System - Niedrigenergie-Bluetooth Anwendungen und Vorgaben für den Fahrkartenverkauf

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CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels

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European foreword

This document (CEN/TR 17311:2019) has been prepared by Technical Committee CEN/TC 278 “Intelligent transport systems”, the secretariat of which is held by NEN.

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1 Scope

The intention of this document is to review what was done to envision the limits of the proposed technique and related schemes which will be described and to define what could be submitted to standards. Concepts which are to be used for BLE in IFM are based on a highly spread technology which is BLE. This is not limited to any trademark or proprietary scheme. Therefore any person having a smartphone can use this technology with prerequisite to have a Bluetooth version greater than 4.0 and a dedicated application on board the smartphone.

The background of this document is related to usage in Account Based Ticketing frame (see related document made in ISO/TC 204/WG 8). There is no information related to the IFM itself.

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 terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at http://www.electropedia.org/
- ISO Online browsing platform: available at http://www.iso.org/obp

4 Symbols and abbreviations

TR	Technical Report
EN	European Standard

5 Introduction to BLE

5.1 What is BLE

Bluetooth low energy (BLE) is a wireless personal area network technology designed and marketed by the Bluetooth Special Interest Group aimed at novel applications in the healthcare, fitness, beacons, security, and home entertainment industries. Compared to Classic Bluetooth, BLE is intended to provide considerably reduced power consumption and cost while maintaining a similar communication range.

The Bluetooth Low Energy identifies a number of markets for low energy technology, particularly in the smart home, health, sport and fitness sectors. Cited advantages include: low power requirements, operating for “months or years” on a small size button cell and low cost compatibility with a large installed base of mobile phones, tablets and computers.

Compared to classic Bluetooth technology, BLE has the characteristics as shown in Table 1.

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Table 1 — Comparison between classic Bluetooth and Bluetooth Low Energy

Technical specification	Classic Bluetooth technology	Bluetooth Low Energy
Distance/range (theoretical max.)	100 m	> 100 m
Over the air data rate	1 Mbit/s to 3 Mbit/s	125 kbit/s – 1 Mbit/s – 2 Mbit/s
Application throughput	0,7 Mbit/s to 2,1 Mbit/s	0,27 Mbit/s
Active slaves	7	Not defined; implementation dependent
Security	56/128-bit and application layer user defined	128-bit AES with Counter Mode CBC-MAC and application layer user defined
Robustness	Adaptive fast frequency hopping, FEC, fast ACK	Adaptive frequency hopping, Lazy Acknowledgement, 24-bit CRC, 32-bit Message Integrity Check
Latency (from a non-connected state)	Typically 100 ms	6 ms
Minimum total time to send data (det. battery life)	100 ms	3 ms
Voice capable	Yes	No
Network topology	Scatternet	Scatternet
Power consumption	1 W as the reference	0,01 W to 0,50 W (depending on use case)
Peak current consumption	< 30 mA	< 15 mA
Service discovery	Yes	Yes
Profile concept	Yes	Yes
Primary use cases	Mobile phones, gaming, headsets, stereo audio streaming, smart homes, wearable, automotive, PCs, security, proximity, healthcare, sports and fitness, etc.	Mobile phones, gaming, smart homes, wearable, automotive, PCs, security, proximity, healthcare, sports and fitness, Industrial, etc.

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BLE uses the same frequency band as Bluetooth (2,4 GHz to 2,5 GHz) and shares this frequency band with other uses (notably WiFi which uses the frequency band 2,4 GHz to 2,6 GHz). To allow for less sensitivity to disturbances, BLE implements a frequency hopping mechanism, thus ensuring clear data transmissions even in rich media of radio links.

Moreover, BLE allows a varied use in terms of implementation since this protocol can be used:

— In connected mode: 2 interlocutors dialogue once paired;

— In network mode: 1 master allows the establishment of a communication with several slaves in a pico-network;

— In beacon mode: 1 element transmits information that anyone who wants to hear can hear.

Last mode looks to be the most popular to applications used in IFM systems even if some implementations in connected mode have been tested.