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Intelligent transport systems — Traffic and travel information (TTI) via transport protocol experts group, generation 2 (TPEG2) —

Part 25: Electromobility charging infrastructure (TPEG2-EMI)

Systèmes intelligents de transport — Informations sur le trafic et le tourisme via le groupe expert du protocole de transport, génération 2 (TPEG2) —

Partie 25: Infrastructure pour l'alimentation en électromobilité (TPEG2-EMI)

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Foreword

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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 document 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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This document was prepared by Technical Committee ISO/TC 204, *Intelligent transport systems*.

This first edition cancels and replaces the first edition (ISO/TS 21219-25:2017), which has been technically revised.

The main changes are as follows:

— the document has been changed from a Technical Specification to an International Standard.

A list of all parts in the ISO 21219 series can be found on the ISO website.

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

0.1 History

TPEG technology was originally proposed by the European Broadcasting Union (EBU) Broadcast Management Committee, who established the B/TPEG project group in the autumn of 1997 with a brief to develop, as soon as possible, a new protocol for broadcasting traffic and travel-related information in the multimedia environment. TPEG technology, its applications and service features were designed to enable travel-related messages to be coded, decoded, filtered and understood by humans (visually and/or audibly in the user's language) and by agent systems. Originally, a byte-oriented data stream format, which can be carried on almost any digital bearer with an appropriate adaptation layer, was developed. Hierarchically structured TPEG messages from service providers to end-users were designed to transfer information from the service provider database to an end-user's equipment.

One year later, in December 1998, the B/TPEG group produced its first EBU specifications. Two documents were released. Part 2 (TPEG-SSF, which became ISO/TS 18234-2) described the syntax, semantics and framing structure which was used for all TPEG applications. Meanwhile, Part 4 (TPEG-RTM, which became ISO/TS 18234-4) described the first application for road traffic messages.

Subsequently, in March 1999, CEN/TC 278, in conjunction with ISO/TC 204, established a group comprising members of the former EBU B/TPEG and this working group continued development work. Further parts were developed to make the initial set of four parts, enabling the implementation of a consistent service. Part 3 (TPEG-SNI, ISO/TS 18234-3) described the service and network information application used by all service implementations to ensure appropriate referencing from one service source to another.

Part 1 (TPEG-INV, later ISO/TS 18234-1) completed the series by describing the other parts and their relationship; it also contained the application IDs used within the other parts. Additionally, Part 5, the public transport information application (TPEG-PTI, later ISO/TS 18234-5), was developed. The so-called TPEG-LOC location referencing method, which enabled both map-based TPEG-decoders and non-map-based ones to deliver either map-based location referencing or human readable text information, was issued as ISO/TS 18234-6 to be used in association with the other applications of parts of the ISO 18234 series to provide location referencing.

The ISO 18234 series has become known as TPEG Generation 1.

0.2 TPEG Generation 2

When the Traveller Information Services Association (TISA), derived from former forums, was inaugurated in December 2007, TPEG development was taken over by TISA and continued in the TPEG applications working group.

It was about this time that the (then) new Unified Modelling Language (UML) was seen as having major advantages for the development of new TPEG applications in communities who would not necessarily have binary physical format skills required to extend the original TPEG TS work. It was also realized that the XML format for TPEG described within the ISO 24530 series (now superseded) had a greater significance than previously foreseen, especially in the content-generation segment, and that keeping two physical formats in synchronism, in different standards series, would be rather difficult.

As a result, TISA set about the development of a new TPEG structure that would be UML-based. This has subsequently become known as TPEG Generation 2.

TPEG2 is embodied in the ISO 21219 series and it comprises many parts that cover introduction, rules, toolkit and application components. TPEG2 is built around UML modelling and has a core of rules that contain the modelling strategy covered in ISO 21219-2, ISO 21219-3 and ISO 21219-4 and the conversion to two current physical formats: binary (see Annex A) and XML (see Annex B); others could be added in the future. TISA uses an automated tool to convert from the agreed UML model XMI file directly into an MS Word document file, to minimize drafting errors; this file forms the annex for each physical format.

TPEG2 has a three-container conceptual structure: message management (ISO 21219-6), application (several parts) and location referencing (ISO/TS 21219-7). This structure has flexible capability and can

accommodate many differing use cases that have been proposed within the TTI sector and wider for hierarchical message content.

TPEG2 also has many location referencing options as required by the service provider community, any of which may be delivered by vectoring data included in the location referencing container.

The following classification provides a helpful grouping of the different TPEG2 parts according to their intended purpose. Note that the list below is potentially incomplete, as there is the possibility that new TPEG2 parts will be introduced after the publication of this document.

— Toolkit parts: TPEG2-INV (ISO 21219-1), TPEG2-UML (ISO 21219-2), TPEG2-UBCR (ISO 21219-3), TPEG2-UXCR (ISO 21219-4), TPEG2-SFW (ISO 21219-5), TPEG2-MMC (ISO 21219-6), TPEG2-LRC (ISO/TS 21219-7).

— Special applications: TPEG2-SNI (ISO 21219-9), TPEG2-CAI (ISO 21219-10), TPEG2-LTE (ISO/TS 21219-24).

— Location referencing: TPEG2-OLR (ISO/TS 21219-22), TPEG2-GLR (ISO/TS 21219-21), TPEG2-TLR (ISO 17572-2), TPEG2-DLR (ISO 17572-3).

— Applications: TPEG2-PKI (ISO 21219-14), TPEG2-TEC (ISO 21219-15), TPEG2-FPI (ISO 21219-16), TPEG2-SPI (ISO 21219-17), TPEG2-TFP (ISO 21219-18), TPEG2-WEA (ISO 21219-19), TPEG2-RMR (ISO/TS 21219-23), TPEG2-EMI (ISO 21219-25 – this document), TPEG2-VLI (ISO/TS 21219-26).

TPEG2 has been developed to be broadly (but not totally) backward compatible with TPEG1 to assist in transitions from earlier implementations, while not hindering the TPEG2 innovative approach and being able to support many new features, such as dealing with applications with both long-term, unchanging content and highly dynamic content, such as parking information.

This document is based on the TISA specification technical/editorial version reference:

SP22004_2.0_001

Intelligent transport systems — Traffic and travel information (TTI) via transport protocol experts group, generation 2 (TPEG2) —

Part 25: Electromobility charging infrastructure (TPEG2-EMI)

1 Scope

This document specifies the "electromobility information" (EMI) TPEG application. The EMI application has been specifically designed to support information about charging infrastructure for electric vehicles (not just cars), the location of e-charging points and their suitability for the respective vehicle (e.g. connector type, charging modality). As electric vehicles will occupy a “charging space” for longer a time than other vehicles, information on availability/waiting time and reservation options are accounted for, as they are highly relevant for enabling a user of an electric vehicle to optimally plan their route/trip.

The standardized delivery, via TPEG technology, of electromobility information has the following benefits to an end user of this TPEG service:

a) identification of suitable charging units for vehicles, thus preventing unnecessary travel to find a fitting unit (also has environmental benefits);

b) verification of the real-time availability of charging units;

c) possibility of planning ahead and reserving a spot in a charging park, thus optimizing trip planning;

d) possibility of selecting a financially attractive charging point in a charging park where the operator has billing agreements with the user’s electromobility provider.

In addition to these end-user benefits, electromobility providers and charging park operators also benefit from a standardized TPEG format as it facilitates harmonization of the electromobility information with the data formats used for the exchange of information between management systems of electromobility providers and charge park operators and related specifications (e.g. Open Charge Alliance,[1] eMobility ICT Interoperability Innovation (eMI^3),[2] etc.).

The EMI application, as an add-on service component next to traffic information, for example, is laid out to support large numbers of charge parks with only modest bandwidth requirements.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 21219-1, *Intelligent transport systems — Traffic and travel information (TTI) via transport protocol experts group, generation 2 (TPEG2) — Part 1: Introduction, numbering and versions (TPEG2-INV)*

ISO 21219-9, *Intelligent transport systems — Traffic and travel information (TTI) via transport protocol experts group, generation 2 (TPEG2) — Part 9: Service and network information (TPEG2-SNI)*

ISO 21219-14, *Intelligent transport systems — Traffic and travel information (TTI) via transport protocol experts group, generation 2 (TPEG2) — Part 14: Parking information (TPEG2-PKI)*

ISO 21219-15, *Intelligent transport systems — Traffic and travel information (TTI) via transport protocol experts group, generation 2 (TPEG2) — Part 15: Traffic event compact (TPEG2-TEC)*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

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/

3.1
electric vehicle
EV
vehicle that is (partly) electrically powered and operated

Note 1 to entry: With respect to the TPEG requirements, electric vehicles such as e-bikes are considered in addition to electric cars.

Note 2 to entry: Electric vehicle (EV) batteries can typically be charged at any regular power socket. If fast charging is required (e.g. during longer journeys), higher demands on the technical infrastructure are made. Specific sockets and high-power connector cables have been developed to allow a simple and secure usage of boost charging stations. It is necessary for the end user to know which options are supported by a charging station. EVs can have an "identity" for electronic readout, e.g. by means of a certificate. Other information which can be communicated by an EV to the infrastructure can also be relevant for the execution and planning of charging orders. The current battery charge condition, the power requirements during the charging procedure and the cruising range are parameters that can be relevant for the planning of charging orders. The vehicle and charging station can communicate via the connector cable, but other mechanisms are also possible, e.g. using the back-end system of the EV-manufacturer to which an EV is connected (via mobile data connection).

Note 3 to entry: Electromobility information (EMI) also covers the requirements for hybrid (partly electrically powered) vehicles.

3.2
charging park
grouping of multiple physical charging stations which technically and/or logically belong together and are being operated together

Note 1 to entry: A commercially operated car park or in a city district where publicly operated charging stations are grouped together.

Note 2 to entry: Charging parks are being operated by charging park operators.

3.3
charging station
physical unit (typically a column or cabinet-like structure) containing and managing one or more charging points offering the end user the possibility to authorize (typically by means of a card reader) and activate one of the charging points at the charging station, hook up the vehicle, and start the charging procedure

3.4
charging point
unit in a charging station at which an electric vehicle can be supplied with power

Note 1 to entry: A charging station may provide multiple charging points, which again may contain multiple sockets to support more than one charging connector type. In general, as soon as one socket at a charging point is in use, the charging point is occupied. Typically, a parking space is provided for each charging point at the charging station.

3.5
energy provider
business partner supplying energy to charging parks and their operators

Note 1 to entry: This includes all relevant energy suppliers, i.e. local solar power generators as well as traditional major companies in the power industry sector.

3.6
electromobility provider
EM provider
business partner for end users who charge their electric vehicles

Note 1 to entry: Typically, an end user has a contract with an electromobility provider (EM provider), the details of which are connected to an (RF) ID-card [having an (internationally) unique card number] that is used for authorization and billing. The EM provider ensures that their customers can charge their vehicles in as many charging parks as possible and bills the customer according to the respective contract.

3.7
charging park operator
entity which manages one or more charging parks

Note 1 to entry: The charging park operator maintains the charging site(s) and is a business partner to the energy provider and the electromobility provider (EM provider). Typically, a charging park operator bills the end user based on “roaming agreements” with multiple EM providers.

3.8
EVSE ID
electric vehicle supply equipment identity
globally unique identifier which identifies a specific charging point

Note 1 to entry: If a charging station has multiple charging points, multiple EVSE IDs are used. See also DIN SPEC 91286.[16]

3.9
Reference-English “word”
word which enables information to be transmitted as a concept, thereby letting the receiver device choose the best possible representation of the given concept in the context of the other parts of the message

Note 1 to entry: This approach means that devices can present concepts in any language or even as graphical icons, for example. For further explanation, see ISO 21219-2.

Note 2 to entry: [SOURCE: ISO 21219-9:2023, 3.10]

4 Abbreviated terms

For the purposes of this document, the abbreviated terms in ISO 21219-1, ISO 21219-9, ISO 21219-14, ISO 21219-15, and the following shall apply.

ADC	application data container
EM provider	electromobility provider
EV	electric vehicle
EVSE ID	electric vehicle supply equipment identity
MMC	message management container
RF	radio frequency

5 Application specific constraints

5.1 Application identification

The word "application" is used in the TPEG specifications to describe specific subsets of the TPEG structure. An application defines a limited vocabulary for a certain type of messages, for example, parking information or road traffic information. Each TPEG application is assigned a unique number, called the application identity (AID). An AID is defined in ISO 21219-1 whenever a new application is developed.

The AID number is used within the TPEG2-SNI application (ISO 21219-9) to indicate how to process TPEG content. It facilitates the routing of information to the appropriate application decoder.

5.2 Version number signalling

Version numbering is used to track the separate versions of an application through its development and deployment. The differences between these versions could have an impact on client devices.

The version numbering principle is defined in ISO 21219-1.

Table 1 shows the current version numbers for signalling EMI within the SNI application.

Table 1 — Current version numbers for signalling of EMI

Major version number	**2**
Minor version number	**0**

5.3 Ordered components

TPEG2-EMI requires a fixed order of TPEG components. The order for the EMI message component is shown in Figure 1. The first component shall be the message management container (MMC). This shall be the only component if the message is a cancellation message. Otherwise, the MMC component shall be followed by one or more application data container (ADC) component(s) which includes the application-specific information.

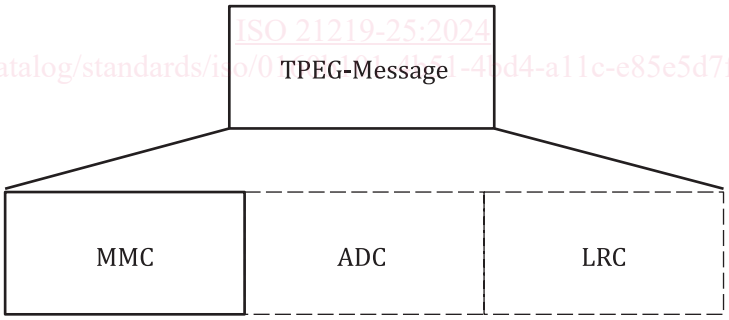


Figure 1 — Composition of TPEG messages

5.4 Extension

Although it is necessary to maintain a fixed component order, this does not prevent the extension of a TPEG2-EMI message generally. In case of future extensions, new components may be inserted, or existing components may be replaced by new ones without losing backward compatibility. This requires that a TEC decoder shall be able to detect and skip unknown components.

5.5 TPEG service component frame

TPEG2-EMI (this document) makes use of the "service component frame with dataCRC and messageCount" according to ISO 21219-5.

6 EMI structure

6.1 Introduction

This clause specifies the main structure of EMI and its capabilities.

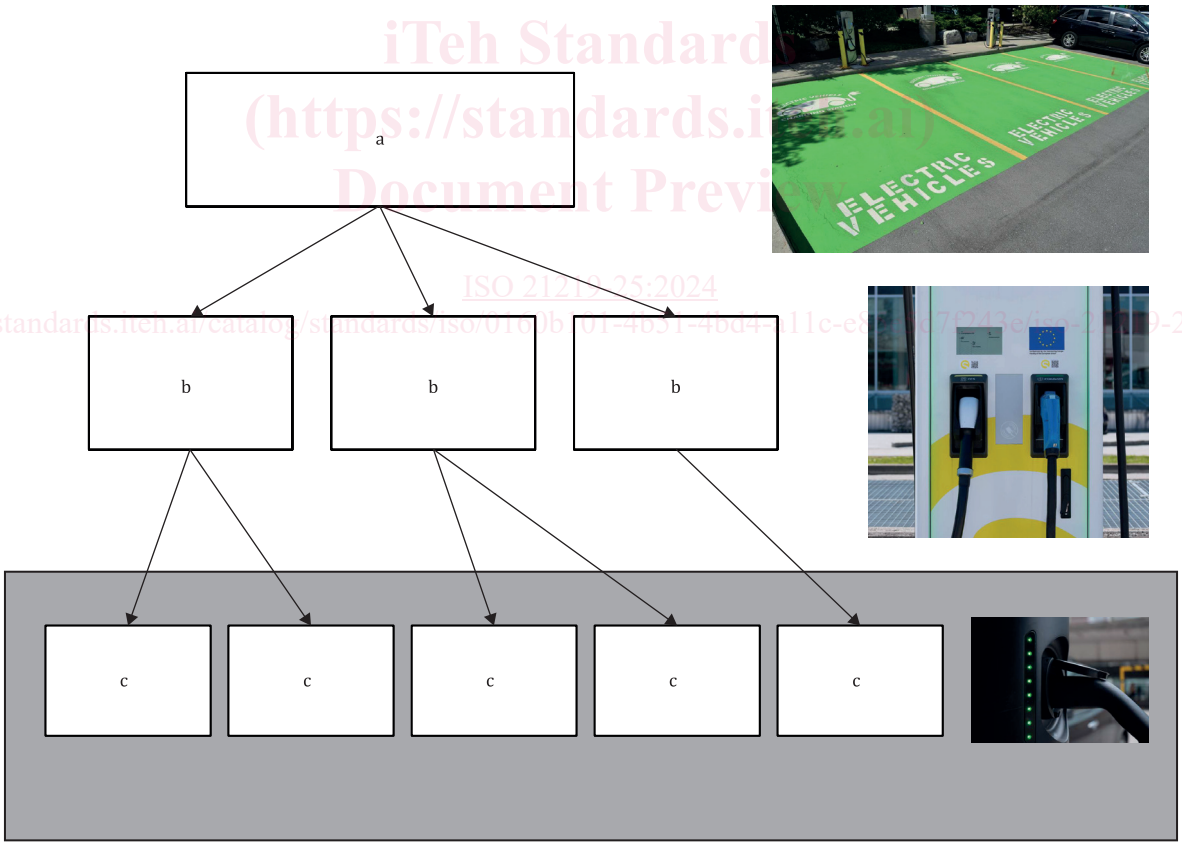
The EMI design is based on a distinction between information with a generally static reference-style nature with an expected low refresh rate and information of a more dynamic nature status with a high expected refresh rate. The binary format and XML format of the TPEG2-EMI application for use in transmission shall be in accordance with Annexes A and B, respectively.

6.2 EMI structuring considerations

6.2.1 Information aggregation level: charging parks, charging stations, charging points

EMI (see structure in Figure 2) is required to provide an end user with enough information to find a suitable and available charging point at which to charge their electric vehicle. The number of charging points within a TPEG service can become too high to transmit all descriptive data as part of the general service. Therefore, in EMI, information is aggregated either at charging park or charging station level. This approach supports efficient use of the transmission channel.

From an end user point of view, it is generally sufficient to obtain information at the level of a charging station: the physical location of a charging station is sufficient information to satisfy the user need. The user does not need to know which physical charging point at a charging station would be available, for example.



Key

a Charging park.

b Charging station.

c Charging point.

Figure 2 — EMI structure

Detailed information on a specific charging point can become relevant to an end user wanting to make a reservation at a specific charging station. Therefore, in addition to the information provisioning on charging parks and charging stations, EMI supports a request and response session, to allow a reservation for a specific charging point at a given charging station or in a charging park (see 6.2.3).

6.2.2 Static vs. dynamic information: charging park information, charging park availability

An EMI service provider needs to be able to provide a TPEG client with a large amount of data at a relatively low transmission data rate. The typical TPEG concept, in which a single TPEG message equates with a single content item, cannot be applied for EMI, as it would take too much time to provide clients without any pre-existing information (e.g. transit users) with useable data. Some form of transmission at high repetition rates for minimum content, augmented with low repetition rate for additional detailed content is therefore required.

Moreover, EMI contains both information that is generally static (typically descriptive information on charging parks, see Figure 3) and information that is potentially updated frequently (such as the availability information, see Figure 4). EMI also needs to consider this information quality to support different repetition rates.

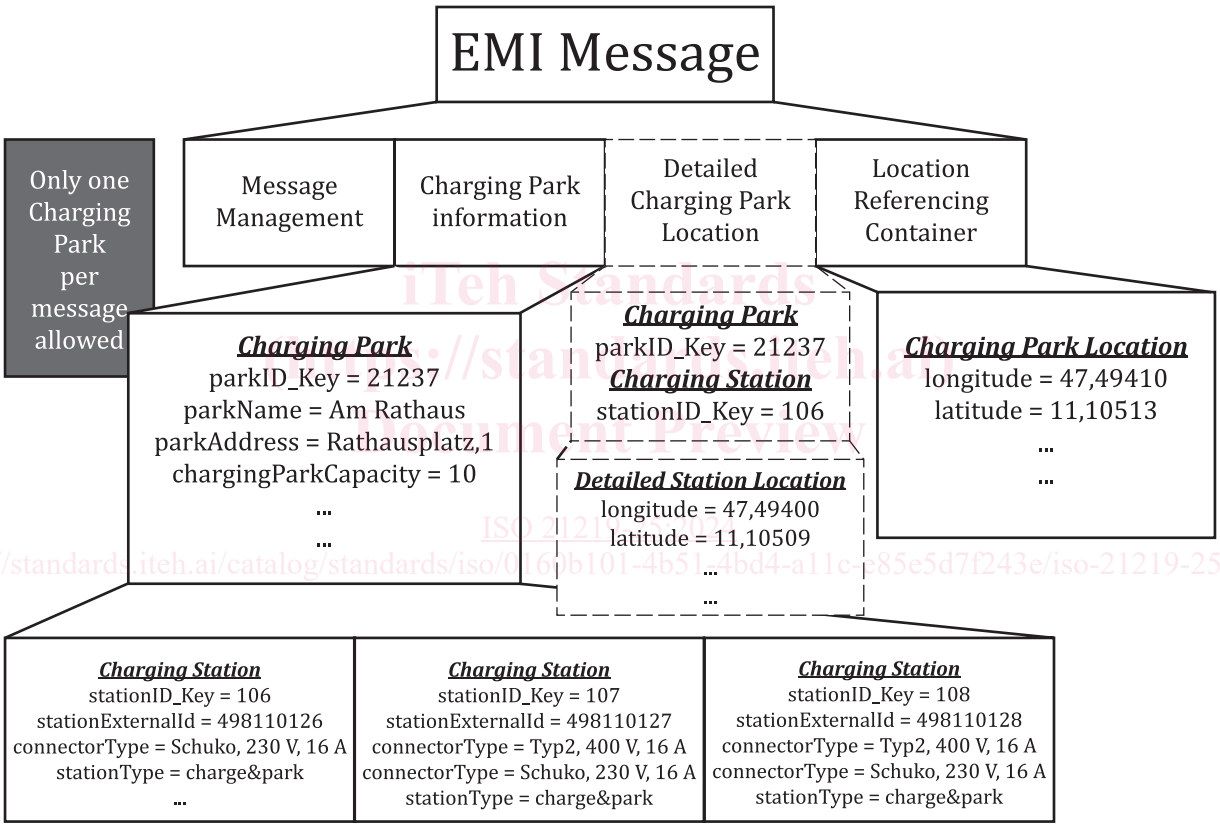


Figure 3 — Static information (example)