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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 committee responsible for this document is ISO/TC 204, *Intelligent transport systems*.

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

# Introduction

## 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 may 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, 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, 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 parts of the ISO/TS 18234 series to provide location referencing.

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

## 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/TS 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/TS 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/TS 21219-2, ISO/TS 21219-3, ISO/TS 21219-4 and the conversion to two current physical formats: binary and XML; 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, that forms the annex for each physical format.

 

TPEG2 has a three container conceptual structure: Message Management (ISO/TS 21219-6), Application (several parts) and Location Referencing (ISO/TS 21219-7[1]). 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.

— Toolkit parts: TPEG2-INV (ISO/TS 21219-1), TPEG2-UML (ISO/TS 21219-2), TPEG2-UBCR (ISO/TS 21219-3), TPEG2-UXCR (ISO/TS 21219-4), TPEG2-SFW (ISO/TS 21219-5), TPEG2-MMC (ISO/TS 21219-6), TPEG2-LRC (ISO/TS 21219-7), TPEG2-LTE (ISO/TS 21219-24);

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

— Location Referencing: TPEG2-ULR (ISO/TS 21219-11[2]), TPEG2-GLR (ISO/TS 21219-21[3]), TPEG2-OLR (ISO/TS 21219-22[4]);

— Applications: TPEG2-PKI (ISO/TS 21219-14), TPEG2-TEC (ISO/TS 21219-15), TPEG2-FPI (ISO/TS 21219-16), TPEG2-TFP (ISO/TS 21219-18), TPEG2-WEA (ISO/TS 21219-19), TPEG2-RMR (ISO/TS 21219-23), TPEG2-EMI (ISO/TS 21219-25).

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 having 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:

SP13010/1.0/001



1) Under development.

2) Under development.

3) Under development.

4) Under development.

 

# 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 defines the TPEG application electromobility charging infrastructure (EMI). It 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 a longer period of time, information on availability/waiting time and reservation options are highly relevant for a user of an electric vehicle to optimally plan his route/trip and are therefore also accounted for.

The standardized delivery, through a TPEG technology, of information on charging infrastructures has the following benefits to an end user of this TPEG service:



a) Identifying suitable charging units for his vehicle, thus preventing unnecessary driving around to find a fitting unit (also has environmental benefits).

b) Verifying the real-time availability of charging units.



c) Being able to plan ahead and reserve a spot in a charging park and thus optimize the planning of his trip.

d) Being able to select a financially attractive charging point in a charging park the operator of which has billing agreements with the user's electromobility provider.

In addition to these end-user benefits, also electromobility providers and charging park operators benefit from a standardized TPEG format as it allows an easier harmonization of the electromobility charging infrastructure information with the data formats used for the exchange of information between management systems of electromobility providers and charge park operators and according specifications (e.g. Open Charge Alliance[5]), eMobility ICT Interoperability Innovation (eMI$^3$)[6]), etc.).

The TPEG application electromobility charging infrastructure, as add-on service component next to, for example traffic information, 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 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/TS 18234-11:2013, *Intelligent transport systems — Traffic and Travel Information (TTI) via transport protocol experts group, generation 1 (TPEG1) binary data format — Part 11: Location Referencing Container (TPEG1-LRC)*

5) http://www.openchargealliance.org/

6) http://emi3group.com/

ISO/TS 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/TS 21219-5, *Intelligent transport systems — Traffic and travel information (TTI) via transport protocol experts group, generation 2 (TPEG2) — Part 5: Service framework (TPEG2-SFW)*

ISO/TS 21219-6, *Intelligent transport systems — Traffic and travel information (TTI) via transport protocol experts group, generation 2 (TPEG2) — Part 6: Message management container (TPEG2-MMC)*

ISO/TS 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)*

## 3 Terms and definitions

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

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

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



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

Note 2 to entry: EV batteries can typically be charged at any regular power socket. In case 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* (3.3). It is necessary for the end user to know which options are supported by a charging station. EVs may have an "identity" for electronic readout, e.g. by means of a certificate. Also, other information which can be communicated by an EV to the infrastructure may be relevant for the execution and planning of charging orders. The current battery charge condition, the power requirements during the charging procedure, as well as the cruising range are parameters that may be relevant for the planning of charging orders. The vehicle and charging station can communicate using a connector cable, but also other mechanisms are possible, e.g. using the back-end system of an EV manufacturer, to which an EV is connected (using mobile data connection).

**3.2**
**charging park**
park that consists of multiple physical *charging stations* (3.3) which technically and/or logically belong together and are being operated together

Note 1 to entry: This may be the case, for example, in a commercially operated car park or in a city district where publicly operated charging stations are grouped together. Charging parks are being operated by *charging park operators* (3.7).

**3.3**
**charging station**
station that consists of a physical unit (typically a column or cabinet-like structure) containing and managing one or more *charging points* (3.4) offering the end-user the possibility to be authorized (typically by means of a card reader) and activate one of the charging points at the charging station, hook up the *electric vehicle* (3.1) and start the charging procedure

 

**3.4**
**charging point**
unit in a *charging station* (3.3) at which an *electric vehicle* (3.1) can be supplied with power

Note 1 to entry: A charging station can provide multiple charging points, which again can 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 for each charging point, a parking space is provided at the charging station.

**3.5**
**energy provider**
provider that includes all relevant energy suppliers, local solar power generators, as well as traditional major companies in the power industry sector

Note 1 to entry: It is their role to provide energy to the *charging park operators* (3.7).

**3.6**
**electromobility provider**
**EM provider**
business partner for the end-users who charge their *electric vehicles* (3.1)

Note 1 to entry: Typically, an end-user has a contract with an 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 sees to it that his customers can charge their vehicles in as many *charging parks* (3.2) as possible and bills the customer according to the respective contract.



**3.7**
**charging park operator**
operator who manages one or more *charging parks* (3.2)

Note 1 to entry: The charging park operator maintains the charging site(s) and is a business partner to the energy provider and the *EM provider* (3.6). Typically, a charging park operator bills the end-user based on "roaming agreements" with multiple EM providers.



**3.8**
**electric vehicle supply equipment identity**
**EVSEID**
ID that uniquely identifies a concrete *charging point* (3.4) globally

Note 1 to entry: If a *charging station* (3.3) has multiple charging points, multiple EVSEIDs are used. See also DIN SPEC 91286.

# 4 Abbreviated terms

ACID Application and Content Identifier

ADC Application Data Container

CEN Comité Européen de Normalization

EBU European Broadcasting Union

EM ElectroMobility

EMI ElectroMobility Charging Infrastructure

EV Electric Vehicle

EVSE Electric Vehicle Supply Equipment

EVSEID Electric Vehicle Supply Equipment Identity

LRC Location Referencing Container

MMC Message Management Container

OSI Open Systems Interconnection

SFW TPEG Service Framework: Modelling and Conversion Rules

TISA Traveller Information Services Association

TPEG Transport Protocol Expert Group

TTI Traffic and Traveller Information

UML Unified Modelling Language

# 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 IDentification (AID). An AID is defined whenever a new application is developed and these are all listed in ISO/TS 21219-1.



The application identification number is used within the TPEG2-SNI application ISO/TS 21219-9 to indicate how to process TPEG content and 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 can have an impact on client devices.

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

Table 1 shows the current version numbers for signalling EMI within the SNI application ISO/TS 21219-9.

**Table 1 — Current version numbers for signalling of EMI**

| | |
|---|---|
| major version number | 1 |
| 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.* This shall be the only component if the message is a cancellation message. Otherwise, the MMC component shall be followed by the one or more *Application Data Container* component(s) which includes the application-specific information.

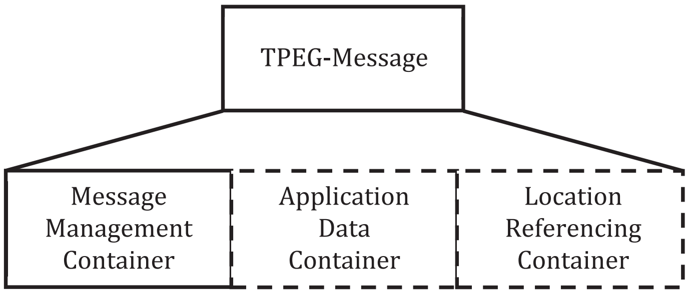


**Figure 1 — Composition of TPEG messages**

### 5.4 Extension

The requirement of a fixed component order does not affect the extension of EMI. Future application extensions may insert new components or may replace existing components by new ones without losing backward compatibility. An EMI decoder shall be able to detect and skip unknown components.

### 5.5 TPEG Service Component Frame

EMI makes use of the "Service Component Frame with dataCRC and messageCount" according to ISO/TS 21219-5 (TPEG2-SFW).



## 6 EMI structure

### 6.1 Overview



In Clause 6, the main structure of EMI and its capabilities are explained.

The EMI design is based on a distinction between information with a generally static reference style with an expected low refresh rate, and information of a more dynamic nature status with an expected high refresh rate.

## 6.2 EMI structuring considerations

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

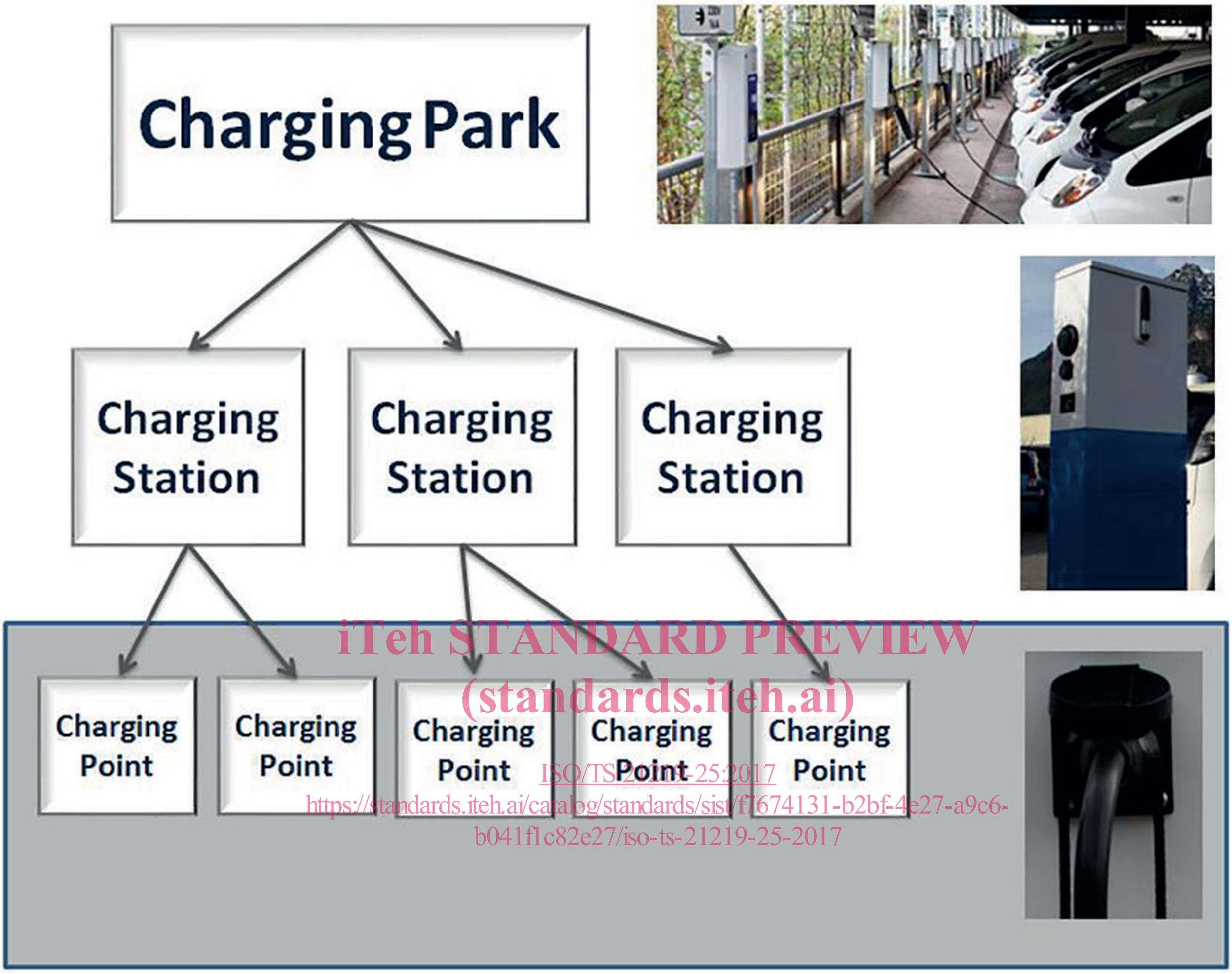




**Figure 2 — EMI Structure**

EMI (see structure in Figure 2) must provide an end user with enough information to find a suitable and available charging point to charge his electric vehicle. From an end user point of view, it is sufficient to obtain information at the level of a charging station: the physical location of a charging station matching user needs by providing sufficient information. It is not relevant for the user to know e.g. which physical charging point at a charging station would be available.

Therefore, in EMI information is aggregated either at charging park or charging station level. By doing so, EMI also takes into account that the number of charging points within a TPEG service may become too high to transmit all descriptive data as part of the general service. Thus, this approach supports efficient use of the transmission channel.

Detailed information on a specific charging point may 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, respectively); 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 some useable data. Some form of transmission at high repetition rates for minimum content, augmented with low repetition rate for additional detailed content is then required.

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

EMI has been designed to allow service providers to arrange their transmissions flexibly, depending on the volume of data to be transmitted and the available data rate. A TPEG message may contain partial or complete content for a charging park/charging station. A service provider may choose to aggregate descriptive information at the level of charging park in case only limited data rate is available. This typically static information shall be combined with location information.



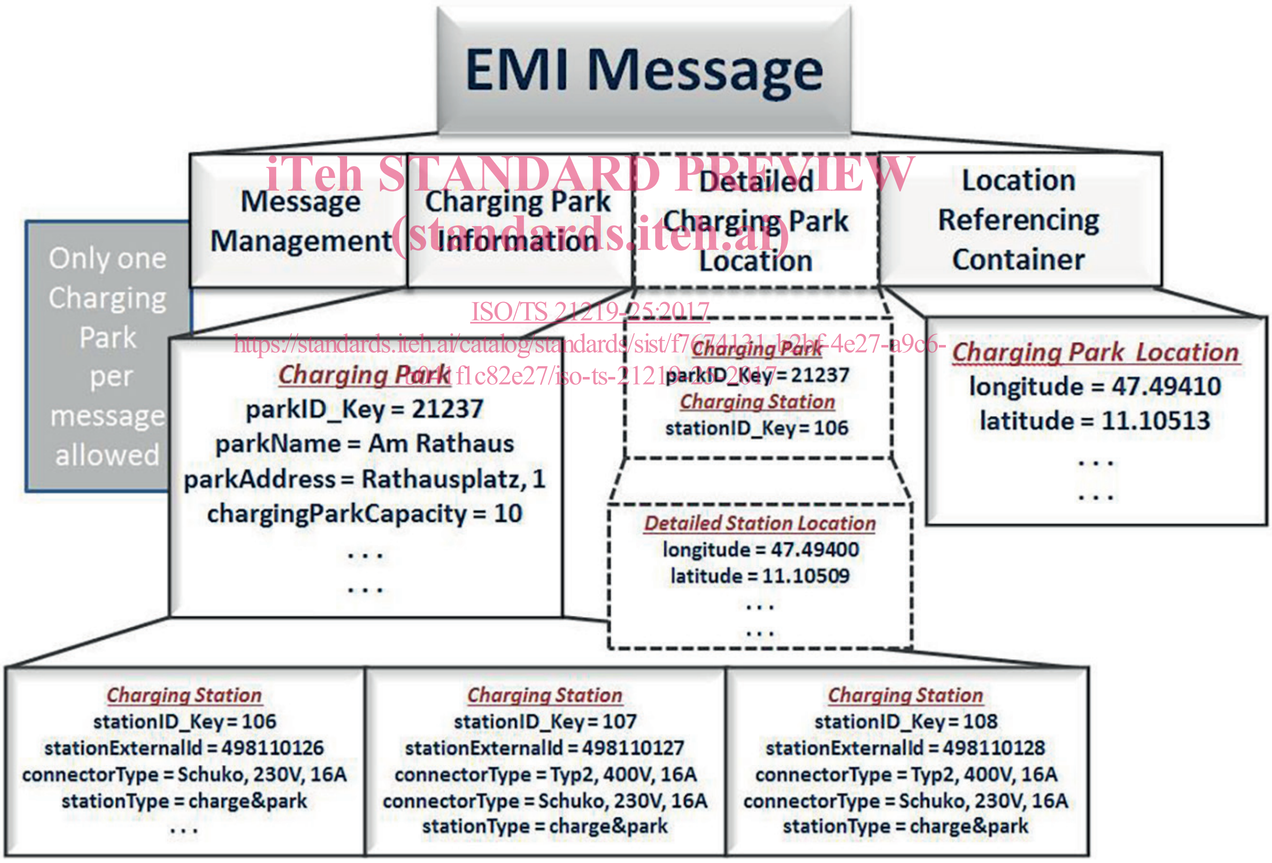


**Figure 3 — Static information (example)**

The availability information for charging parks/charging stations (typically highly dynamic information) is contained in separate data structures, which have been kept limited and compact to allow it to be transmitted with a higher refresh rate than the descriptive information. TPEG messages containing availability information shall not contain location information. Based on respective ID keys the TPEG client can recombine the availability information with the other information for charging parks and charging stations.