
**Intelligent transport systems (ITS) —
Nomadic device service platform for
micro mobility —**

**Part 2:
Functional requirements and dataset
definitions**

*Systèmes de transport intelligents - Plateforme de services de
dispositifs portables pour la micro mobilité - Partie 2 : Exigences
fonctionnelles et définitions des données —*

Partie 2: Exigences fonctionnelles et définitions des données



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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).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

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 204, *Intelligent transport systems*.

A list of all parts in the ISO 22085 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

Micro mobility can be defined as a small or compact-sized electric vehicle. Normally, it is designed to be used as a first-mile and last-mile service connecting public transit routes or to provide personal mobility with one or two passengers for a short-distance trip.

The nomadic device service platform aims to accommodate the specific needs of integrated mobility services for either urban or rural areas. The service platform focuses on the use of data exchange interface standards between micro mobility and nomadic devices to enable the development of cloud-based ITS using wireless networks.

This document fosters the introduction of nomadic devices in the public transport and automotive world. It specifies functional requirements and dataset definitions based on Vehicle Interface Data Format (VIDF) at the application level regarding pre-trip, post-trip and while driving, in order to identify connectivity between a user's personal ITS stations (P-ITS-S, for example nomadic devices), roadside-ITS-station, vehicle-ITS-station gateway (V-ITS-S) and central ITS station (C-ITS-S). The functional requirements and the dataset can be used as a measure for exchanging information required to implement mobility services to be included in integrated mobility and parcel delivery services.

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Intelligent transport systems (ITS) — Nomadic device service platform for micro mobility —

Part 2: Functional requirements and dataset definitions

1 Scope

This document provides definitions of functional requirements for connectivity among nomadic devices, cloud servers and micro mobility during pre-trip, post-trip and while driving, which is defined in ISO/TR 22085-1, and datasets for providing seamless mobility service. In addition, it also delivers related standards required to develop and operate the service platform between a nomadic device and micro mobility with intelligent transport systems (ITS) technologies. The functional requirements and the datasets can be used as a measure of exchanging information required to promote micro mobility as a new type of urban and rural transport mode, and so increase the possibility of being included in an integrated mobility and parcel delivery system.

This document defines functional requirements and messages set by use case and a dataset of each message to provide services for use cases, which are defined in ISO/TR 22085-1 as follows:

- Pre-trip (Use case 1.1-1.5)
- En-route (Use case 2.1-2.7)
- Post-trip (Use case 3.1-3.4)

2 Normative references

There are no normative references in this document.

3 Terms, definitions, symbols and abbreviated terms

3.1 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:

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

3.1.1

central ITS station

C-ITS-S

network server between personal ITS server (i.e. nomadic device or mobile device) and micro mobility service provider

3.1.2

personal ITS station

P-ITS-S

implementation of an ITS station as a personal ITS subsystem (e.g. nomadic device or mobile device) which provides communication connectivity via a wireless communication network (3G, 4G, and 5G), mobile wireless broadband (WiMAX, HC-SDMA, etc.), WiFi and short-range links, such as Bluetooth, Zigbee, etc. to connect portable devices to the motor vehicle communications system network

3.1.3

micro mobility

MM

new concept of eco-friendly personal electric vehicle for one or two passengers

3.1.4

in mobility network

IMN

local network bus among electrical control units in MM, providing diagnostics information to P-ITS-S through vehicle-ITS-station gateway (V-ITS-S)

3.1.5

micro mobility service provider

MMSP

service provider including parking lot management service, public transit authority, charging station management service, tolling service authority, car sharing service, traffic information service, etc.

3.1.6

micro mobility communication network

MMCN

communication network between P-ITS-S and C-ITS-S

3.1.7

public communication network

PCN

network between MMCS and service providers used to provide MM services information on, for example, charging stations, parking lots and traffic congestion

3.2 Abbreviated terms

C	conditional
Cvt.	convention (M, O, C)
DTC	diagnostic trouble code
EXE	executor
FR	functional requirement
IMN	in mobility network
ITIPS	interconnected transfer information providing service
ND	nomadic device
M	mandatory
MEC	mobile edge computing
MM	micro-mobility

MMCN	micro mobility communication network
MMCS	micro-mobility cloud server
MTS	mobile tolling service
O	optional
OBD	on board diagnostic
PCN	public communication network
R-ITS-S	roadside-intelligent transport system-station
SOC	state of charge
SAPSS	searching available parking space service on the way
SMMRS	shared micro mobility return service
V-ITS-S	vehicle ITS station
WiFi	wireless fidelity

4 Document overview and structure

This document provides all documents and references required to support the implementation of the requirements related to standardized access to nomadic device service platforms for micro mobility. This document consists of three sections:

- General information is provided in [Clause 5](#).

[Clause 5](#) provides a purpose and overview, including a service framework architecture.

- Functional requirements and messages set by use case are described in [Clause 6](#).

[Clause 6](#) specifies all use case technical requirements and datasets related to nomadic device service platforms for micro mobility to be interfaced with micro mobility cloud servers and micro mobility service providers. The requirements reflect functional requirements as specified in this document.

- Datasets are described in [Clause 7](#).

[Clause 7](#) provides definitions of each message including message ID, dataset and data type.

5 General information

5.1 Purpose

This document addresses two major areas:

- Identification of the functional requirements for describing the P-ITS-S interfaced with V-ITS-S and C-ITS-S (or MMCS).
- Definition of the message set required in the general use cases defined in ISO/TR 22085-1.
- Definition of the dataset of each message from the use cases.

5.2 Use case overview

Conceptual aspects of the general use cases of ISO/TR 22085-1 are shown in [Figure 1](#) and are summarized in [Table 1](#).

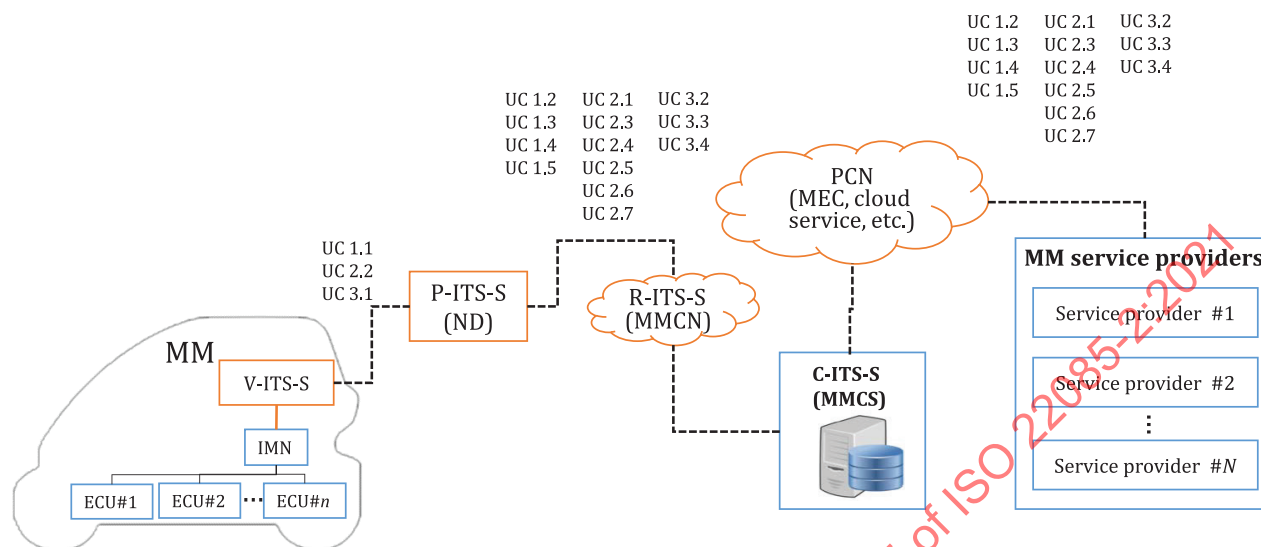


Figure 1 — Conceptual aspects of the general use cases in ISO/TR 22085-1

Table 1 — Use cases clusters and associated use cases overview

Title of use cases cluster	Brief description
1. Pre-trip	This cluster specifies the detailed use cases at the pre-trip stage for micro mobility. It includes 5 different use cases, including MM information providing service, navigation service linked information on charging stations, pre-scanning available parking space service, micro mobility sharing service and micro mobility as an integrated mobility service. — UC 1.1 – Micro mobility information providing services — UC 1.2 – Navigation service linked information on charging stations — UC 1.3 – Pre-scanning available parking space services — UC 1.4 – Micro mobility sharing services — UC 1.5 – Micro mobility as an integrated mobility service

Table 1 (continued)

Title of use cases cluster	Brief description
2. En-route	This cluster specifies the detailed use cases at the en-route stage for micro mobility. It includes 7 different use cases, including traffic information providing service, micro mobility fault management service, mobile tolling service, adaptive route management service, searching available parking space service on the way, keyless go service for shared micro mobility and interconnected transfer information providing service. — UC 2.1 – Traffic information providing service — UC 2.2 – Micro mobility status monitoring service — UC 2.3 – Mobile tolling service — UC 2.4 – Adaptive route management service — UC 2.5 – Searching available parking space service on the way. — UC 2.6 – Keyless go service for shared micro mobility — UC 2.7 – Interconnected transfer information providing service
3. Post-trip	This cluster specifies the detailed use cases at the post-trip stage for micro mobility. It includes 4 different use cases, including micro mobility driving information providing service, charging station information service, parked micro mobility position providing service and sharing micro mobility return service. — UC 3.1 – Micro mobility driving information providing service — UC 3.2 – Charging station information service — UC 3.3 – Parked micro mobility position providing service — UC 3.4 – Sharing micro mobility return service

6 Functional requirements and dataset definition

6.1 Functional requirements

This document provides functional requirements (FRs) for providing integrated mobility or postal delivery services using a P-ITS-S, for instance, a nomadic device.

The FRs consist of connectivity, power supply, data collection and data storing for services provided in pre-trip, post-trip, and en-route phases, and requirements for components of the service platform (i.e., P-ITS-S, V-ITS-S, C-ITS-S [or MMCS]).

6.1.1 Functional requirements with related general use cases

Table 2 — Functional requirements overview

FR#	Description
FR1	IMN of MM provides V-ITS-S with status information (mileage, SOC, DTC) of MM.
FR2	V-ITS-S provides P-ITS-S with status information of MM.
FR3	P-ITS-S provides status information of MM to a driver.
FR4	P-ITS-S sends location information along with MM status to C-ITS-S.
FR5	P-ITS-S should always be in V2N (vehicle-to-network) with MM.
FR6	C-ITS-S manages all MM-related information (e.g. charging station, parking space, navigation route information, toll balance information).
FR7	C-ITS-S stores MM driving information and calculates balance after driving.

6.1.2 Functional requirements for the connectivity among P-ITS-S, MM and MMCS

6.1.2.1 P-ITS-S

The P-ITS-S is always interfaced with the V-ITS-S via a wireless communication link.

6.1.2.2 MM

MM should include interfaces which can transfer the MM's information to the P-ITS-S and the MMCS.

6.1.2.3 C-ITS-S (or MMCS)

The C-ITS-S (or MMCS) should be able to store and accumulate information related to the MM's status.

The C-ITS-S (or MMCS) should include interfaces through which data can be exchanged between the C-ITS-S and public service providers (e.g. car sharing service, etc.).

6.2 Dataset definitions

6.2.1 Introduction

This document provides dataset definitions which contain required data and the required data type for each use case defined in ISO/TR 22085-1, in order to provide integrated mobility or a postal delivery service.

6.2.2 Pre-trip

6.2.2.1 General

The following subclauses define datasets in the pre-trip phase, including information on vehicle identification, location and status, which is provided to an MM driver through a P-ITS-S.

6.2.2.2 UC 1.1 Micro mobility information providing service

Use case 1.1 requires a dataset containing the status information of the MM. When the MM is chosen, V-ITS-S-ID and status information of the MM and an MM driver's P-ITS-S identification is transferred to a C-ITS-S (or MMCS) for providing services in use case 1.1. [Table 3](#) shows data, data type and a description of the dataset required for use case 1.1.

Table 3 — Dataset definition for use case 1.1

Use case	Cluster	1- Pre-trip		Micro mobility (MM) identification (V-ITS-S-ID) and status information such as SOC, DTC is provided to MM driver, who utilizes it to decide to choose the MM or not.
	Name	UC 1.1 — Micro mobility information providing service		
Messages	Subclause	Name	Exe	Description
	7.1	request-mm-status	P	Request that V-ITS-S notifies MM status with SOC, DTC, mileage and V-ITS-S-ID.
	7.2	mm-status-response	V	Send MM status information (SOC, DTC, mileage) to P-ITS-S.
	7.3	stop-notify-mm-status	P	Stop the communication to the V-ITS-S.
	7.4	notify-mm-service	P	Send MM status information, V-ITS-S-ID, position and user information to C-ITS-S. After the first contact, send only the P-ITS-S position and MM status information, V-ITS-S-ID, in a predefined time interval.
	7.5	stop-notify-mm-service	P	Stop the communication to the C-ITS-S.

6.2.2.3 UC 1.2 Navigation service linked information on charging station

Use case 1.2 requires a dataset to provide routes-linked information on charging station to an MM driver. When a destination is set, the C-ITS-S (or MMCS) collects information on expected routes for the MM and locations of charging stations. Then, the C-ITS-S (or MMCS) transfers them to the P-ITS-S. Information on locations of charging stations includes charging stations on the way to or nearest to the destination. [Table 4](#) shows data, data type and a description of the dataset required for use case 1.2.

Table 4 — Dataset definition for use case 1.2

Use Case	Cluster	1- Pre-trip		The route to destination is guided with the charging station information on a P-ITS-S. The location of the charging station can include that which is nearest to the destination, or one on the way to the destination.
	Name	UC 1.2 — Navigation service linked information on charging station		
Messages	Sub-clause	Name	Exe	Description
	7.1	request-mm-status	P	Request that V-ITS-S notifies MM status with SOC, DTC, mileage and V-ITS-S-ID.
	7.2	mm-status-response	V	Send MM status information (SOC, DTC, mileage) to P-ITS-S.
	7.3	stop-notify-mm-status	P	Stop the communication to the V-ITS-S.
	7.4	notify-mm-service	P	Send MM status information, V-ITS-S-ID, position and user information to C-ITS-S. After the first contact, send only the P-ITS-S position and MM status information, V-ITS-S-ID, in a predefined time interval.
	7.6	charging-station-information	C	Send charging station location to the P-ITS-S.
	7.11	navigation-route-information	C	Send navigation route information to the P-ITS-S.
	7.5	stop-notify-mm-service	P	Stop the communication to the C-ITS-S.

6.2.2.4 UC 1.3 Pre-scanning available parking space service

Use case 1.3 requires a dataset for providing information to an MM driver in pre-trip phase on available parking spaces near to the destination. The C-ITS-S (or MMCS) transfers the information on available parking spaces near to the destination to the P-ITS-S. [Table 5](#) shows data, data type and a description of the dataset required for use case 1.3.

Table 5 — Dataset definition for use case 1.3

Use Case	Cluster	1- Pre-trip	Description
	Name	UC 1.3 — Pre-scanning available parking space service	
			Prior to driving, available parking space information near to the destination is scanned and provided on the P-ITS-S, related with the navigation service defined in UC 1.3.

Table 5 (continued)

Messages	Sub-clause	Name	Exe	Description
	7.1	request-mm-status	P	Request that V-ITS-S notifies MM status with SOC, DTC, mileage and V-ITS-S-ID.
	7.2	mm-status-response	V	Send MM status information (SOC, DTC and mileage) to P-ITS-S.
	7.3	stop-notify-mm-status	P	Stop the communication to the V-ITS-S.
	7.4	notify-mm-service	P	Send MM status information, V-ITS-S-ID, position and user information to C-ITS-S. After the first contact, send only the P-ITS-S position and MM status information, V-ITS-S-ID, in a predefined time interval.
	7.7	parking-space-information	C	Send available parking space information to the P-ITS-S.
	7.11	navigation-route-information	C	Send navigation route information to the P-ITS-S.
	7.5	stop-notify-mm-service	P	Stop the communication to the C-ITS-S.

6.2.2.5 UC 1.4 Micro mobility sharing service

Use case 1.4 requires a dataset to provide information related to the MM sharing service. Information related to searching available MM, reservation and payment is transferred to a C-ITS-S (or MMCS). [Table 6](#) shows data, data type and a description of the dataset required for use case 1.4.

Table 6 — Dataset definition for use case 1.4

Use Case	Cluster	1- Pre-trip	Reserves MM for sharing service and displays reserved information on a P-ITS-S.	
	Name	UC 1.4 — Micro mobility sharing service	Available MM information is provided by a C-ITS-S (or MMCS).	
Messages	Sub-clause	Name	Exe	Description
	7.1	request-mm-status	P	Request that V-ITS-S notifies MM status with SOC, DTC, mileage and V-ITS-S-ID.
	7.2	mm-status-response	V	Send MM status information (SOC, DTC, mileage) to P-ITS-S.
	7.3	stop-notify-mm-status	P	Stop the communication to the V-ITS-S.
	7.4	notify-mm-service	P	Send MM status information, V-ITS-S-ID, position and user information to C-ITS-S. After the first contact, send only the P-ITS-S position and MM status information, V-ITS-S-ID, in a predefined time interval.
	7.8	reservation-acceptance	C	Send reservation acceptance information to the P-ITS-S.
	7.5	stop-notify-mm-service	P	Stop the communication to the C-ITS-S.

6.2.2.6 UC 1.5 Micro mobility as an integrated mobility service

Use case 1.5 requires a dataset to provide information to an MM driver which is related to transferring to public transportation before/after using MM. The C-ITS-S (or MMCS) transfers information to P-ITS-S. Concerning transferable public transportation and available stations related to the MM driver's destination. [Table 7](#) shows data, data type and a description of the dataset required for use case 1.5.

Table 7 — Dataset definition for use case 1.5

Use Case	Cluster	1- Pre-trip		Provides interconnected public transit transfer information to MM driver on the P-ITS-S.
	Name	UC 1.5 — Micro mobility as an integrated mobility service		
Messages	Sub-clause	Name	Exe	Description
	7.1	request-mm-status	P	Request that V-ITS-S notifies MM status with SOC, DTC, mileage and V-ITS-S-ID
	7.2	mm-status-response	V	Send MM status information (SOC, DTC, mileage) to the P-ITS-S.
	7.3	stop-notify-mm-status	P	Stop the communication to the V-ITS-S.
	7.4	notify-mm-service	P	Send MM status information, V-ITS-S-ID, position and user information to C-ITS-S. After the first contact, send only the P-ITS-S position and MM status information, V-ITS-S-ID, in a predefined time interval.
	7.9	public-transit-schedule	C	Send public transit information with arrival/departure time and transit type to P-ITS-S.
	7.5	stop-notify-mm-service	P	Stop the communication to the C-ITS-S.

6.2.3 En-route

6.2.3.1 General

The following subclauses define datasets in the en-route phase, including information on MM operation and traffic in the surrounding area, which is provided to an MM driver and a C-ITS-S (or MMCS) through a P-ITS-S.

6.2.3.2 UC 2.1 Traffic information providing service

Use case 2.1 requires a dataset to provide information to an MM driver relating to traffic around the MM while driving. The P-ITS-S transfers route information to the C-ITS-S (or MMCS). That C-ITS-S (or MMCS) then transfers traffic information around the route to an MM driver through P-ITS-S. [Table 8](#) shows data, data type and a description of the dataset required for use case 2.1.

Table 8 — Dataset definition for use case 2.1

Use Case	Cluster	2- En-route		While driving, traffic information is provided by a C-ITS-S (or MMCS) in real time. To provide traffic information, route information on a P-ITS-S is sent to a C-ITS-S (or MMCS). Then, a C-ITS-S (or MMCS) requests the relevant traffic information provider through a PCN.
	Name	UC 2.1 — Traffic information providing service		
Messages	Sub-clause	Name	Exe	Description
	7.4	notify-mm-service	P	Send MM status information, V-ITS-S-ID, position and user information to C-ITS-S. After the first contact, send only the P-ITS-S position and MM status information, V-ITS-S-ID, in a predefined time interval.
	7.12	traffic-information	C	Send traffic information to the P-ITS-S.
	7.13	accident-information	C	Send accident location information to the P-ITS-S.
	7.14	danger-zone-information	C	Send danger zone location information to the P-ITS-S.
	7.5	stop-notify-mm-service	P	Stop the communication to the C-ITS-S.

6.2.3.3 UC 2.2 Micro mobility status monitoring service

Use case 2.2 requires a dataset to provide information to an MM driver when a fault or a malfunction occurs in an MM while driving. A V-ITS-S transfers information to a P-ITS-S in a case of malfunction in the MM. [Table 9](#) shows data, data type and a description of the dataset required for use case 2.2.

Table 9 — Dataset definition for use case 2.2

Use Case	Cluster	2- En-route		MM diagnostic information is provided to a driver by V-ITS-S while driving when a major electrical component such as the inverter, battery, etc. is in fault or malfunction status. To provide MM DTC information, the V-ITS-S broadcasts DTC information to the P-ITS-S.
	Name	UC 2.2 — Micro mobility status monitoring service		
Messages	Sub-clause	Name	Exe	Description
	7.1	request-mm-status	P	Request that the V-ITS-S notifies MM status with SOC, DTC, mileage and V-ITS-S-ID.
	7.2	mm-status-response	V	Send MM status information (SOC, DTC, mileage) to P-ITS-S.
	7.3	stop-notify-mm-status	P	Stop the communication to the V-ITS-S.
	7.4	notify-mm-service	P	Send MM status information, V-ITS-S-ID, position, and user information to C-ITS-S. After the first contact, send only the P-ITS-S position and MM status information, V-ITS-S-ID, in a predefined time interval.
	7.15	warning-message	C	Send warning message containing corresponding DTC description information to the P-ITS-S.
	7.5	stop-notify-mm-service	P	Stop the communication to the C-ITS-S.

6.2.3.4 UC 2.3 Mobile tolling service

Use case 2.3 requires a dataset to provide toll payment information to an MM driver when an MM drives through a toll gate. A toll service provider and a payment service provider transfer the payment information to the P-ITS-S. [Table 10](#) shows data, data type and a description of the dataset required for use case 2.3.

Table 10 — Dataset definition for use case 2.3

Use Case	Cluster	2- En-route		Toll payment is requested through a C-ITS-S (or MMCS) when the MM passes toll roads. MTS is provided to MM driver by the combination of following service providers, such as payment service provider, communication service operator, and toll road management service provider.
	Name	UC 2.3 — Mobile tolling service		
Messages	Chapter	Name	Exe	Description
	7.1	request-mm-status	P	Request that V-ITS-S notifies MM status with SOC, DTC, mileage, V-ITS-S-ID.
	7.2	mm-status-response	V	Send MM status information (SOC, DTC, mileage) to the P-ITS-S.
	7.3	stop-notify-mm-status	P	Stop the communication to the V-ITS-S.
	7.4	notify-mm-service	P	Send MM status information, V-ITS-S-ID, position and user information to C-ITS-S. After the first contact, send only the P-ITS-S position and MM status information, V-ITS-S-ID, in a predefined time interval.
	7.16	toll-balance-information	C	Send toll balance information to the P-ITS-S.
	7.19	payment-information	P	Send the user’s payment information to the C-ITS-S.
	7.5	stop-notify-mm-service	P	Stop the communication to the C-ITS-S.

6.2.3.5 UC 2.4 Adaptive route management service

Use case 2.4 requires a dataset to provide new route information to an MM driver when an MM deviates from a route set in a pre-trip phase. A P-ITS-S transfers information related to the MM's current location to a C-ITS-S (or MMCS). That C-ITS-S (or MMCS) then transfers new route information to P-ITS-S, taking into consideration the surrounding traffic and locations of charging stations. [Table 11](#) shows data, data type and a description of the dataset required for use case 2.4.

Table 11 — Dataset definition for use case 2.4

Use Case	Cluster	2- En-route		New route to destination is provided by MMCS when MM deviates from a planned route while driving. To suggest a new route to destination, the C-ITS-S (or MMCS) receives traffic condition and charging station information from relevant service providers. Then, the C-ITS-S (or MMCS) sends the information to the P-ITS-S.
	Name	UC 2.4 — Adaptive route management service		
Messages	Sub-clause	Name	Exe	Description
	7.1	request-mm-status	P	Request that V-ITS-S notifies MM status with SOC, DTC, mileage and V-ITS-S-ID.
	7.2	mm-status-response	V	Send MM status information (SOC, DTC, mileage) to the P-ITS-S.
	7.3	stop-notify-mm-status	P	Stop the communication to the V-ITS-S.
	7.4	notify-mm-service	P	Send MM status information, V-ITS-S-ID, position, and user information to C-ITS-S. After the first contact, send only the P-ITS-S position and MM status information, V-ITS-S-ID, in a predefined time interval.
	7.6	charging-station-information	C	Send charging station location to the P-ITS-S.
	7.11	navigation-route-information	C	Send navigation route information to the P-ITS-S.
	7.5	stop-notify-mm-service	P	Stop the communication to the C-ITS-S.

6.2.3.6 UC 2.5 Searching available parking space service on the way

Before an MM arrives at a destination, use case 2.5 requires a dataset to provide information on available parking spaces near to an MM driver and a driving route can be recalculated if necessary. The C-ITS-S (or MMCS) transfers information on available parking spaces near to a destination to the P-ITS-S automatically. [Table 12](#) shows data, data type and a description of the dataset required for use case 2.5.

Table 12 — Dataset definition for use case 2.5

Use Case	Cluster	2- En-route	Before MM approaches its destination, available parking space information near to the destination is searched and provided on the P-ITS-S. If necessary, navigation routes can be re-searched according to available parking spaces. SAPSS automatically requests to search available parking spaces near to the destination.
	Name	UC 2.5 — Searching available parking space service on the way	

Table 12 (continued)

Messages	Sub-clause	Name	Exe	Description
	7.1	request-mm-status	P	Request that V-ITS-S notifies MM status with SOC, DTC, mileage, V-ITS-S-ID.
	7.2	mm-status-response	V	Send MM status information (SOC, DTC, mileage) to the P-ITS-S.
	7.3	stop-notify-mm-status	P	Stop the communication to the V-ITS-S.
	7.4	notify-mm-service	P	Send MM status information, V-ITS-S-ID, position, and user information to C-ITS-S. After the first contact, send only the P-ITS-S position and MM status information, V-ITS-S-ID, in a predefined time interval.
	7.7	parking-space-information	C	Send available parking space information to the P-ITS-S.
	7.11	navigation-route-information	C	Send navigation route information to the P-ITS-S.
	7.5	stop-notify-mm-service	P	Stop the communication to the C-ITS-S.

6.2.3.7 UC 2.6 Keyless go service for shared micro mobility

When MM is disconnected from P-ITS-S while driving, use case 2.6 requires dataset to lock the MM. When MM is disconnected from P-ITS-S, a warning message is transferred to P-ITS-S. [Table 13](#) shows data, data type and a description of the dataset required for use case 2.6.

Table 13 — Dataset definition for use case 2.6

Use Case	Cluster	2- En-route		
	Name	UC 2.6 — Keyless go service for shared micro mobility		
Messages	Sub-clause	Name	Exe	Description
	7.1	request-mm-status	P	Request that V-ITS-S notifies MM status with SOC, DTC, mileage and V-ITS-S-ID.
	7.2	mm-status-response	V	Send MM status information (SOC, DTC, mileage) to P-ITS-S
	7.4	notify-mm-service	P	Send MM status information, V-ITS-S-ID, position and user information to C-ITS-S. After the first contact, send only the P-ITS-S position and MM status information, V-ITS-S-ID, in a predefined time interval.
	7.17	disconnection-warning-message	P	A message of disconnection occurrence is sent to the P-ITS-S while the driver is away from the MM.
	7.5	stop-notify-mm-service	P	Stop the communication to the C-ITS-S.

6.2.3.8 UC 2.7 Interconnected transfer information providing service

After an MM is parked, use case 2.7 requires a dataset to provide information to an MM driver concerning available public transportation services from a parking space to a destination and reservation of this service. C-ITS-S (or MMCS) transfers information on the available public transportation service and reservation of the service, which is provided by a public transportation service provider, to the P-ITS-S. [Table 14](#) shows data, data type and a description of the dataset required for use case 2.7.

Table 14 — Dataset definition for use case 2.7

Use Case	Cluster	2- En-route		ITIPS provides interconnected transfer information and notification of reserved transit mode information.
	Name	UC 2.7 — Interconnected transfer information providing service		
Messages	Sub-clause	Name	Exe	Description
	7.1	request-mm-status	P	Request that V-ITS-S notifies MM status with SOC, DTC, mileage and V-ITS-S-ID.
	7.2	mm-status-response	V	Send MM status information (SOC, DTC, mileage) to P-ITS-S.
	7.3	stop-notify-mm-status	P	Stop the communication to the V-ITS-S.
	7.4	notify-mm-service	P	Send MM status information, V-ITS-S-ID, position and user information to the C-ITS-S. After the first contact, send only the P-ITS-S position and MM status information, V-ITS-S-ID, in a predefined time interval.
	7.20	request-public-transit-schedule	P	Request public transit schedule.
	7.9	public-transit-schedule	C	Send public transit information with arrival/departure time and transit type to the P-ITS-S.
	7.21	request-public-transit-reservation	P	Make public transit reservation if necessary.
	7.10	public-transit-reserved-information	C	Send reservation information to a nomadic device (P-ITS-S).
	7.5	stop-notify-mm-service	P	Stop the communication to the C-ITS-S.

6.2.4 Post-trip

6.2.4.1 General

The following subclauses define datasets in the post-trip phase, including information on vehicle operation after driving, which is provided to an MM driver and a C-ITS-S (or MMCS) through a P-ITS-S.

6.2.4.2 UC 3.1 Micro mobility driving information providing service

Use case 3.1 requires a dataset to provide information to an MM driver concerning an identification, location, status and driving record of an MM, and green mileage points. The driving record is saved in a C-ITS-S (or MMCS) with the MM's identification and the P-ITS-S's identification. [Table 15](#) shows data, data type and a description of the dataset required for use case 3.1.

Table 15 — Dataset definition for use case 3.1

Use Case	Cluster	3- Post-trip	Description
	Name	UC 3.1—Micro mobility driving information providing service	

Table 15 (continued)

Messages	Chapter	Name	Exe	Description
	7.1	request-mm-status	P	Request that V-ITS-S notifies MM status with SOC, DTC, mileage and V-ITS-S-ID.
	7.2	mm-status-response	V	Send MM status information (SOC, DTC, mileage) to P-ITS-S.
	7.3	stop-notify-mm-status	P	Stop the communication to the V-ITS-S.
	7.4	notify-mm-service	P	Send MM status information, V-ITS-S-ID, position and user information to the C-ITS-S. After the first contact, send only the P-ITS-S position and MM status information, V-ITS-S-ID, in a predefined time interval.
	7.5	stop-notify-mm-service	P	Stop the communication to the C-ITS-S.

6.2.4.3 UC 3.2 Charging station information service

Use case 3.2 requires a dataset about locations of charging stations, which is provided to an MM driver in preparation for a new trip. This use case is optional and can be omitted if SOC of the MM is more than 70 %. [Table 16](#) shows data, data type and a description of the dataset required for use case 3.2.

Table 16 — Dataset definition for use case 3.2

Use Case	Cluster	3- Post-trip		To provide charging station location, the P-ITS-S checks the remaining battery power level when the MM arrives at the destination. Then, depending on SOC, the P-ITS-S provides the location of the charging station closest to the MM.
	Name	UC 3.2 —Charging station information service		
Messages	Sub-clause	Name	Exe	Description
	7.1	request-mm-status	P	Request that V-ITS-S notifies MM status with SOC, DTC, mileage and V-ITS-S-ID.
	7.2	mm-status-response	V	Send MM status information (SOC, DTC, mileage) to P-ITS-S.
	7.3	stop-notify-mm-status	P	Stop the communication to the V-ITS-S.
	7.4	notify-mm-service	P	Send MM status information, V-ITS-S-ID, position, and user information to C-ITS-S. After the first contact, send only the P-ITS-S position and MM status information, V-ITS-S-ID, in a predefined time interval.
	7.6	charging-station-information	C	Send the charging station location to the P-ITS-S.
	7.5	stop-notify-mm-service	P	Stop the communication to the C-ITS-S.

6.2.4.4 UC 3.3 Parked micro mobility position providing service

Use case 3.3 requires a dataset about the MM's location in a parking space, which is provided to a new MM driver. After driving, the MM's location in a parking space is transferred to a C-ITS-S (or MMCS). This information is then provided to the new MM driver to facilitate a new trip. [Table 17](#) shows data, data type and a description of dataset required for use case 3.3.

Table 17 — Dataset definition for use case 3.3

Use Case	Cluster	3- Post-trip	When MM arrives at the destination, the P-ITS-S sends MM parked position to the C-ITS-S (or MMCS) for providing MM position to driver. To provide the parked position to a driver, the P-ITS-S receives the stored parked MM position from the C-ITS-S (or MMCS). Then the P-ITS-S guides the driver to the parked MM position.
	Name	UC 3.3 — Parked micro mobility position providing service	

Table 17 (continued)

Messages	Sub-clause	Name	Exe	Description
	7.1	request-mm-status	P	Request that V-ITS-S notifies MM status with SOC, DTC, mileage and V-ITS-S-ID.
	7.2	mm-status-response	V	Send MM status information (V-ITS-S-ID, SOC, DTC) to the P-ITS-S.
	7.3	stop-notify-mm-status	P	Stop the communication to the V-ITS-S.
	7.4	notify-mm-service	P	Send MM status information, V-ITS-S-ID, position and user information to the C-ITS-S. After the first contact, send only the P-ITS-S position and MM status information, V-ITS-S-ID, in a predefined time interval.
	7.5	stop-notify-mm-service	P	Stop the communication to the C-ITS-S.

6.2.4.5 UC 3.4 Shared micro mobility return service

Use case 3.3 requires a dataset which is necessary when an MM for a sharing service is returned. Information on driving distance and time, SOC, parking location, satisfaction of service and green mileage points is transferred to the C-ITS-S (or MMCS). This information is then used for service improvement in the future. [Table 18](#) shows data, data type and a description of the dataset required for use case 3.4.

Table 18 — Dataset definition for use case 3.4

Use Case	Cluster	3- Post-trip		Payment service is requested through C-ITS-S (or MMCS) when MM is returned. SMMRS is provided to the MM driver by a combination of the following service providers: payment service provider, communication service operator and sharing service provider.
	Name	UC 3.4 — Shared micro mobility return service		
Messages	Sub-clause	Name	Exe	Description
	7.1	request-mm-status	P	Request that V-ITS-S notifies MM status with SOC, DTC, mileage and V-ITS-S-ID.
	7.2	mm-status-response	V	Send MM status information (V-ITS-S-ID, SOC, DTC) to the P-ITS-S.
	7.3	stop-notify-mm-status	P	Stop the communication to the V-ITS-S.
	7.4	notify-mm-service	P	Send MM status information, V-ITS-S-ID, position, and user information to the C-ITS-S. After the first contact, send only the P-ITS-S position and MM status information V-ITS-S-ID, in a predefined time interval.
	7.18	balance-information	C	Send balance information to the P-ITS-S.
	7.19	payment-information	P	Send the user's payment information to the C-ITS-S.
	7.5	stop-notify-mm-service	P	Stop the communication to the C-ITS-S.

7 Dataset definitions

7.1 request-mm-status

[Table 19](#) defines the dataset `request-mm-status` to request MM status information, V-ITS-S ID, to the nomadic device (P-ITS-S).

Table 19 — Definition of request-mm-status

Msg	ID	1		Request that V-ITS-S notifies MM status with SOC, DTC, mileage and V-ITS-S-ID.	
	Name	request-mm-status			
	Exec	P-ITS-S			
Dataset	Name		Data Type [unit]	Description	Cvt
	-- no dataset --				

7.2 mm-status-response

Table 20 defines the dataset `mm-status-response` to send MM status information to the nomadic device (P-ITS-S).

Table 20 — Definition of mm-status-response

Msg	ID	2		Send MM status information (V-ITS-S-ID, SOC, DTC and mileage) to the P-ITS-S.	
	Name	mm-status-response			
	Exec	V-ITS-S			
Dataset	Name		Data Type [unit]	Description	Cvt
	V-ITS-S-ID		textString	Terminal ID of V-ITS-S	M
	MM status		Group	Current status of MM	M
	- SOC		- numeric2 [%]	State of charge of the battery	M
	- DTC		- enumString	Diagnostic trouble code of the MM	M
	- Mileage		- numeric4 [m]	Current mileage of the MM	M

7.3 stop-notify-mm-status

Table 21 defines the dataset `stop-notify-mm-status` to stop the communication from the vehicle (V-ITS-S).

Table 21 — Definition of stop-notify-mm-status

Msg	ID	3		Stop sending MM status information to the P-ITS-S.	
	Name	stop-notify-mm-status			
	Exec	P-ITS-S			
Dataset	Name		Data Type [unit]	Description	Cvt
	-- no dataset --				

7.4 notify-mm-service

Table 22 defines the dataset `notify-mm-service` to send MM status information, V-ITS-S-ID, position, user information from the P-ITS-S to the C-ITS-S.

Table 22 — Definition of notify-mm-service

Msg	ID	4		Send MM status information, V-ITS-S-ID, position, and user information to the C-ITS-S. After the first contact, send only the P-ITS-S position and MM status information, V-ITS-S-ID, in a predefined time interval.	
	Name	notify-mm-service			
	Exec	P-ITS-S			
Dataset	Name		Data Type [unit]	Description	Cvt
	V-ITS-S-ID		textString	Terminal ID of V-ITS-S	M
	MM status		Group	Current status of MM	M
	- SOC		- numeric2 [%]	State of charge of the battery	M
	- DTC		- enumString	Diagnostic trouble code of the MM	M
	- Mileage		- numeric4 [m]	Current mileage of the MM	M
	Position		Group	Current position of MM	M
	- Latitude		- numeric4 [°N]	Geographic longitude of the position, expressed in 1/8 th integer micro degrees	M
	- Longitude		- numeric4 [°E]	Geographic latitude of the position, expressed in 1/8 th integer micro degrees	M
	- Elevation		- numeric2 [m]	Elevation of the position, expressed in decimetres above the reference ellipsoid (unsigned), offset by 1 km; 0 = 1 km below the reference ellipsoid	O
	Indoor position		Group	Current position of vehicle (Indoor)	O
	- X-axis		- numeric4 [m]	Indoor position of MM/vehicle (x)	O
	- Y-axis		- numeric4 [m]	Indoor position of MM/vehicle (y)	O
	- Z-axis		- numeric4 [m]	Indoor position of MM/vehicle (z)	O

7.5 stop-notify-mm-service

Table 23 defines the dataset `notify-mm-service` to send MM status information, V-ITS-S-ID, position and user information from the P-ITS-S to the C-ITS-S.

Table 23 — Definition of stop-notify-mm-service

Msg	ID	5		Stop the communication to the C-ITS-S.	
	Name	stop-notify-mm-service			
	Exec	P-ITS-S			
Dataset	Name		DataType [unit]	Description	Cvt
	-- no dataset --				

7.6 charging-station-information

Table 24 defines the dataset `charging-station-information` to send charging station location information from the server (C-ITS-S) to the nomadic device (P-ITS-S).

Table 24 — Definition of charging-station

Msg	ID	6	Send charging station location to the P-ITS-S.	
	Name	charging-station-information		
	Exec	C-ITS-S		
Dataset	Name	Data Type [unit]	Description	Cvt
	Station location	Group	Charging station coordinate	M
	- Latitude	- numeric4 [°N]	Geographic longitude of the position, expressed in 1/8 th integer micro degrees	M
	- Longitude	- numeric4 [°E]	Geographic latitude of the position, expressed in 1/8 th integer micro degrees	M
	- Elevation	- numeric2 [m]	Elevation of the position, expressed in decimetres above the reference ellipsoid (unsigned), offset by 1 km; 0 = 1 km below the reference ellipsoid	O

7.7 parking-space-information

Table 25 defines the dataset `parking-space-information` to send available parking space information from the server (C-ITS-S) to the nomadic device (P-ITS-S).

Table 25 — Definition of parking-space-information

Msg	ID	7	Send parking location information to the P-ITS-S.	
	Name	parking-space-information		
	Exec	C-ITS-S		
Dataset	Name	Data Type [unit]	Description	Cvt
	Parking location	Group	Available parking space coordinate	M
	- Latitude	- numeric4 [°N]	Geographic longitude of the position, expressed in 1/8 th integer micro degrees	M
	- Longitude	- numeric4 [°E]	Geographic latitude of the position, expressed in 1/8 th integer micro degrees	M
	- Elevation	- numeric2 [m]	Elevation of the position, expressed in decimetres above the reference ellipsoid (unsigned), offset by 1 km; 0 = 1 km below the reference ellipsoid	O

7.8 reservation-acceptance

Table 26 defines the dataset `reservation-acceptance` to send MM sharing service reservation information from the server (C-ITS-S) to the nomadic device (P-ITS-S).

Table 26 — Definition of reservation-acceptance

Msg	ID	8	Send sharing service reservation information to the P-ITS-S.	
	Name	reservation-acceptance		
	Exec	C-ITS-S		

Table 26 (continued)

Dataset	Name	Data Type [Unit]	Description	Cvt
	User information	Group	User information input	M
	- ID	- enumString	User ID (generated via the P-ITS-S)	M
	- Account number	- enumString	User's account for payment (provided by the P-ITS-S)	M
	- Valid year	- numeric2 [yyyy]	Valid year for payment card	M
	- Valid month	- numeric2 [mm]	Valid month for payment card	M
	- Security number	- enumString	Security number for payment card	M

7.9 public-transit-schedule

Table 27 defines the dataset `public-transit-schedule` to send public transit schedule information from the server (C-ITS-S) to the nomadic device (P-ITS-S).

Table 27 — Definition of public-transit-schedule

Msg	ID	9	Send public transit information with arrival/departure time and transit type to the P-ITS-S.	
	Name	public-transit-schedule		
	Exec	C-ITS-S		
Dataset	Name	Data Type [Unit]	Description	Cvt
	public-transit-location	Group	Public transit coordinate	M
	-Longitude	- numeric4 [°N]	GPS coordinates of station for public transportation (longitude)	M
	-Latitude	- numeric4 [°E]	GPS coordinates of station for public transportation (latitude)	M
	-Altitude	- numeric2 [m]	GPS coordinates of station for public transportation (altitude)	O
	public-transit-schedule	Group	Public transit schedule	M
	-Arrival time	- textString	Arrival time of public transportation to a station	M
	-Departure time	- textString	Departure time of public transportation from a station	M

7.10 public-transit-reserved-information

Table 28 defines the dataset `public-transit-reserved-information` to send public transit reservation information from the server (C-ITS-S) to the nomadic device (P-ITS-S).

Table 28 — Definition of public-transit-reserved-information

Msg	ID	10	Send reserved information to the P-ITS-S.	
	Name	public-transit-reserved-information		
	Exec	C-ITS-S		

Table 28 (continued)

Dataset	Name	Data Type [unit]	Description	Cvt
-- no dataset --				

7.11 navigation-route-information

Table 29 defines the dataset `navigation-route-information` to send navigation route information from the server (C-ITS-S) to the nomadic device (P-ITS-S).

Table 29 — Definition of navigation-route-information

Msg	ID	11		Send navigation route information to the P-ITS-S.	
	Name	navigation-route-information			
	Exec	C-ITS-S			
Dataset	Name		Data Type [unit]	Description	Cvt
	Destination		Group	Destination location	M
	- Latitude		- numeric4 [°N]	Geographic longitude of the position, expressed in 1/8 th integer micro degrees	M
	- Longitude		- numeric4 [°E]	Geographic latitude of the position, expressed in 1/8 th integer micro degrees	M
	- Elevation		- numeric2 [m]	Elevation of the position, expressed in decimetres above the reference ellipsoid (unsigned), offset by 1 km; 0 = 1 km below the reference ellipsoid	O
	Driving route to destination		Group	Driving route to destination	M
	- Waypoint		- array of structure	A list of waypoints to navigate to destination with latitude and longitude	C
	- Driving hour remaining		- numeric2 [s]	Driving time of MM (=end time of trip - start time of trip)	M
	- Remaining distance		- numeric2 [m]	Driving distance of MM recorded by OBD	M

7.12 traffic-information

Table 30 defines the dataset `traffic-information` to send traffic information from the server (C-ITS-S) to the nomadic device (P-ITS-S).

Table 30 — Definition of traffic-information

Msg	ID	12	Send traffic information to the nomadic device (P-ITS-S) from the server (C-ITS-S).
	Name	traffic-information	
	Exec	C-ITS-S	

Table 30 (continued)

Dataset	Name	Data Type [unit]	Description	Cvt
	Traffic information	group	Traffic information	M
	- Link ID	BitString	ID of road on the MM's driving route	M
	- Traffic speed	- numeric2 [m/s ²]	Current traffic speed on road	M
	- Traffic volume	- numeric2 [q]	Current traffic volume on road	M
	- Traffic density	- numeric2 [k]	Current traffic density on road	M

7.13 accident-information

Table 31 defines the dataset `accident-information` to send accident information from the server (C-ITS-S) to the nomadic device (P-ITS-S).

Table 31 — Definition of accident-information

Msg	ID	13	Send accident information from the server (C-ITS-S) to the nomadic device (P-ITS-S).	
	Name	accident-information		
	Exec	C-ITS-S		
Dataset	Name	Data Type [unit]	Description	Cvt
	Accident location	Group	Accident information on road (boundary of 200 m from an accident point)	M
	- Latitude	- numeric4 [°N]	Geographic longitude of the position, expressed in 1/8 th integer micro degrees	M
	- Longitude	- numeric4 [°E]	Geographic latitude of the position, expressed in 1/8 th integer micro degrees	M
	- Elevation	- numeric2 [m]	Elevation of the position, expressed in decimetres above the reference ellipsoid (unsigned), offset by 1 km; 0 = 1 km below the reference ellipsoid	O

7.14 danger-zone-information

Table 32 defines the dataset `danger-zone-information` to send danger zone information from the server (C-ITS-S) to the nomadic device (P-ITS-S).

Table 32 — Definition of danger-zone-information

Msg	ID	14	Send danger zone information from the server (C-ITS-S) to the nomadic device (P-ITS-S).	
	Name	danger-zone-information		
	Exec	C-ITS-S		