



Request for Proposal

CPE Procurement

SSA-T, Appendix 1

Customer Requirement Specification

Version log

Version	Initials	Date	Comments/amendments
1.0			
1.1	KIV	27.02.18	Req. [R148] moved to req. [133]
1.2	KIV	05.03.18	Options located at the end of the document. Reg. 41 and 42 are updated.
1.3	KIV	08.11.18	New req. 147 Removed any reference to signal lights in the document. Removed req. 38 39 and 40 Changed req. 33,44, 56, 57 and 128 Ch. 1.1, 5.2 is rewritten
1.4	DIK	18.10.2019	Part of the Tender documents

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1. INTRODUCTION

1.1 Background

The Norwegian Public Roads Administration is the owner of the AutoPASS system, i.e. the technical specifications for the On Board Unit (OBU) and the Back-Office solutions (Central System).

The equipment at the roadside (Charging Point Equipment (CPE) are owned by the 5 Norwegian Regional Toll Companies (RBPS).

The AutoPASS system offers automatic Charging Points (CPs) allowing for Electronic Fee Collection (EFC) and charging by Licence Plate Reading (LPR).

This document covers the requirements related to the automatic CPs for the AutoPASS system, the requirements related to the communication with the Central System (CS) and the required automatic monitoring functionality via the Monitoring and Control System (MCS).

Appendix 1, Annex 2 (CPE processing of OBE passages), Appendix 1, Annex 7 (AutoPASS OBE specification) describe requirements for the interfaces for communication with the On Board Unit (OBU), data exchange with the CS and security key distribution.

Dataformats to and from Roadside are described in Appendix 1 Annex 6 AutoPASS, chapter 7 (Dataformats). As described in Appendix 3 the integration will be changed to and from ACFC to the new system solutions communicating to and from AutoPASS HUB, however the data formats are unchanged.

Every reference to the Central System (CS) is also transferable to AutoPASS HUB or AutoPASS IP.

1.2 About the Customer

The competition is being run by Vegfinans AS (hereafter referred to as "customer"). Vegfinans is a regional toll company owned by the seven counties Akershus, Buskerud, Hedmark, Oppland, Telemark, Vestfold and Østfold. Through the ownership model, Vegfinans AS have streamlined its administrative duties and the management of the various toll road projects that the company operate. Vegfinans AS is an integral part of the entire lifecycle of the toll road projects, beginning with the planning phase all the way through to the closing of the projects when the toll road has been fully funded, and the various loans have been repaid.

More information about Customer may be found at the following addresses:

Norwegian version: www.vegfinans.no

Additional information: www.autopass.no

2. TERMS AND DEFINITIONS

For terms and definitions please refer to document "Appendix 1 Annex 3 - Terms and definitions".

3. TOLL STATIONS

Charging Point Equipment shall be installed at the defined Charging Points in Appendix 1, Annex 1.

4. RESTRICTIONS, STANDARDS AND DIRECTIVES

4.1 Restrictions

When working at the various Charging Points, the Contractor shall, when applicable, adhere to any restrictions pertaining to inter alia, other ongoing construction work, high voltage facilities, traffic, etc.

4.2 International directives and standards

The deliverables shall fulfil requirements in international standards, directives and hand books as listed below.

4.2.1 Directives

EFC Directive 2004/52/EC on the interoperability of electronic road toll systems in the community Commission Decision on the definition of the EETS and its technical elements (27/3-2009).

Directive 1999/5/EC of the European Parliament and of the Council of 9 March 1999 on radio equipment and telecommunications terminal equipment.

4.2.2 International standards

Standard	What	Year	Document name
EN 12253	Layer 1 OSI-model for DSRC	2004	Road Transport and Traffic Telematics (RTTT) – Dedicated Short-Range Communication (DSRC) Physical layer using microwave at 5.8 GHz
EN 12795	Layer 2 OSI-model for DSRC	2003	Road Transport and Traffic Telematics (RTTT) – Dedicated Short-Range Communication (DSRC) – DSRC data link layer: Medium access and logical link control
EN 12834	Layer 3 OSI-model for DSRC	2003	Road Transport and Traffic Telematics (RTTT) – Dedicated Short-Range Communication (DSRC) – Application Layer
EN 13372	DSRC Profiles	2004	Road Transport and Traffic Telematics (RTTT) – Dedicated Short-Range Communication (DSRC) – Profiles for RTTT applications
EN ISO 14816	Numbering system	2005	Road Traffic and Transport Telematics (RTTT) – Automatic Vehicle and Equipment Identification – Numbering and Data Structures
EN ISO 14906	EFC Application Interface	2004	Road Traffic and Transport Telematics (RTTT) – Electronic Fee Collection – Application interface definition for dedicated short range communication
EN 15509	Application profile for a DSRC standard	2007	EN 15509:2007 Road Traffic and Transport Telematics (RTTT) – Electronic Fee Collection – Interoperability application profile for DSRC
EN 14907 EFC	EFC Application Interface test		Part 1: To prescribe procedures and conditions for tests of EFC-related equipment Part 2: To prescribe conformance tests for On –Board equipment, conforming to ISO 14906

Standard	What	Year	Document name
EN 15876-1	Road transport and traffic telematics	2007	Electronic fee collection. Interoperability application profile for DSRC

4.2.3 Directives and hand books

<ul style="list-style-type: none"> Electromagnetic Compatibility and Radio Spectrum Matters (ERM) – Technical characteristics and test methods for DSRC transmission equipment (500 kbit/s / 250 kbit/s) operating in the 5.8GHz ISM band – Part 1: General Characteristics and test methods for RSU and OBU ETSI EN 300 674-1.
<ul style="list-style-type: none"> Electromagnetic Compatibility and Radio Spectrum Matters (ERM) – Technical characteristics and test methods for DSRC transmission equipment (500 kbit/s / 250 kbit/s) operating in the 5.8GHz ISM band – Part 2-1: Harmonised EN for the RSU under the Radio Equipment Directive 2014/53/EU.
<ul style="list-style-type: none"> EN 15509:2007 Road Traffic and Transport Telematics (RTTT) – Electronic Fee Collection – Interoperability application profile for DSRC
<ul style="list-style-type: none"> Forskrift om elektriske lavspenningsanlegg https://lovdata.no/dokument/SF/forskrift/1998-11-06-1060
<ul style="list-style-type: none"> Håndbok R310 Trafikksikkerhetsutstyr, tekniske krav. (R310E English Version) https://www.vegvesen.no/attachment/61425/binary/1062406?fast_title=H%C3%A5ndbok+R310+Trafikksikkerhetsutstyr.pdf R310E English Version: https://www.vegvesen.no/attachment/194594/binary/964076?fast_title=Manual+R310E+Road+traffic+safety+equipment.pdf
<ul style="list-style-type: none"> Internkontrollforskriften: https://www.arbeidstilsynet.no/regelverk/forskrifter/internkontrollforskriften/

5. AUTOPASS SYSTEM OVERVIEW

5.1 Background

In Norway there are five regional toll companies. Each of these may have one or more AutoPASS Toll System projects which are responsible for the financing of the separate road projects. The regional company's right to collect the toll is regulated in an agreement between the company and the Department of Transport while each project is based on an agreement between a regional Toll Charger and the Norwegian Public Roads Administration.

The toll collection systems in Norway that belongs to AutoPASS support the use of an On Board Unit (OBU). The OBU is a device that contains a Dedicated Short Range Communication (DSRC) interface for communication at 5.8 GHz in accordance with a specification for the physical radio link, the communication protocol and for a specified application. In addition to AutoPASS specified OBUs the toll collection systems supports use of EasyGo OBUs. EasyGo OBUs are OBUs that follow the specifications that have been agreed upon within the EasyGo service.

An AutoPASS User equipped with a compliant OBU (AutoPASS OBU Customer) holds at least a Central Account with a specific Toll Service Provider (TSP). The financing and operation of the toll system is performed by the Toll Charger (TC) based on the project agreement. The Central Account may be based only on post payment.

An AutoPASS Customer is subject to the toll by LPR. The Charging Point takes images (typically front and rear Vehicle Images) of the AutoPASS Customer vehicle when passing the Charging Area, see Figure 2. The AutoPASS Customer is then identified via the vehicle Licence Plate Number and invoiced for the toll.

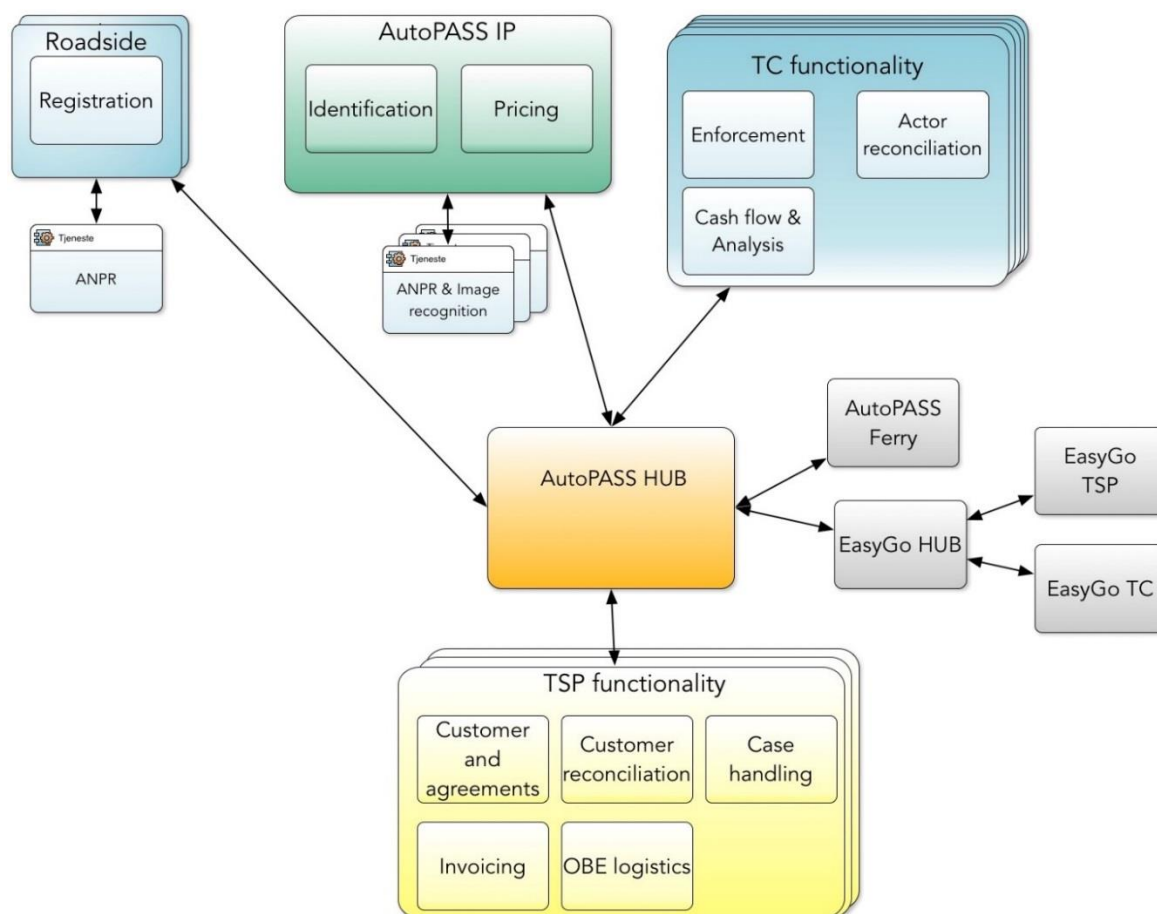


Figure 2 – An illustration of the new system solutions for toll collection in Norway.

5.2 AutoPASS OBU Customer Signaling

Charging Points may give feedback to the AutoPASS User indicating the status at the Toll Service Provider's Central Account or TC's local account.

The system shall be prepared to inform the AutoPASS User by use of sound from the OBU (MMI). This functionality may be configured on or off at the CP's.

The signalling to the AutoPASS OBU Customer is handled based on information from the OBU Statuslist.

5.3 Entities and modules

Figure 3 shows the main entities within an AutoPASS Toll System. To the left of the dotted line in Figure 3 is the Charging Point Equipment (CPE) which is the part covered in this specification.

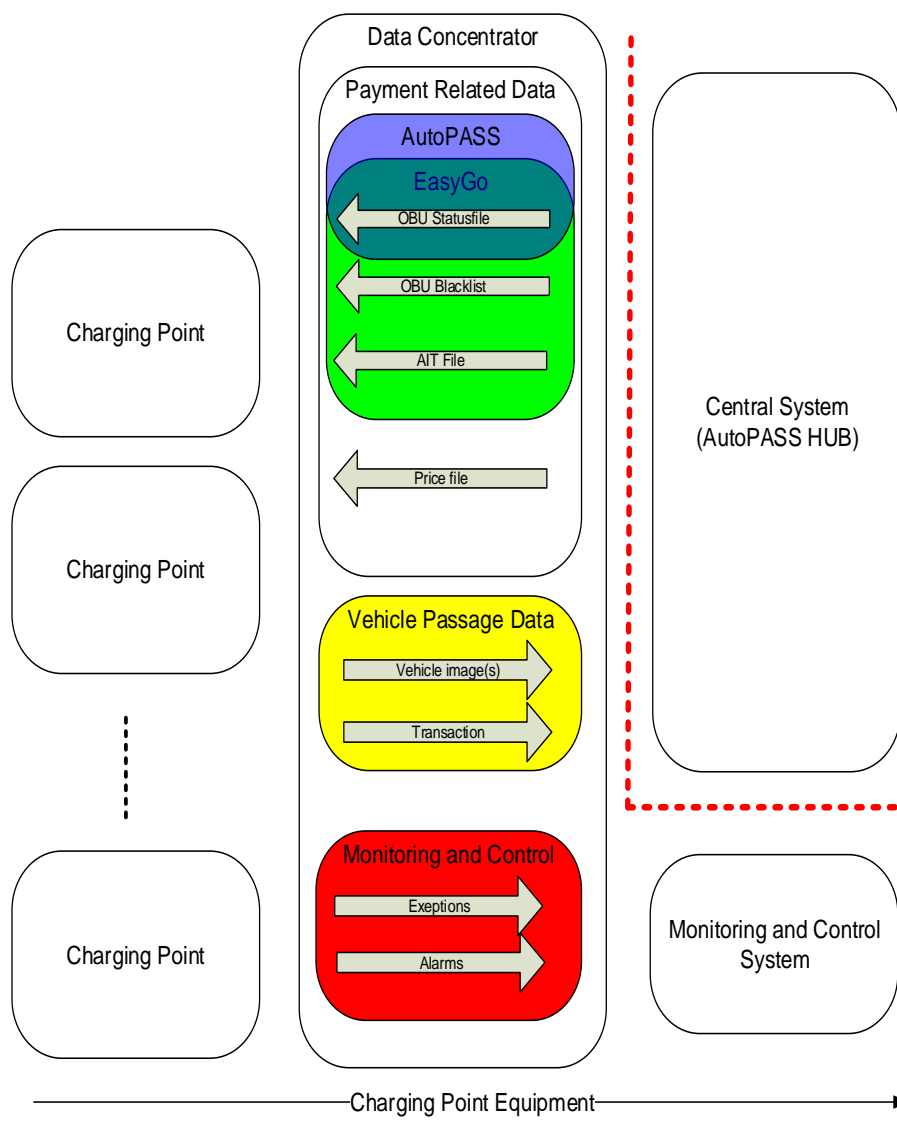


Figure 3 Main entities and modules within an AutoPASS Toll System

To the right of the dotted line in 3 is the Toll Charger's Central System which is computing the toll based on the Vehicle Passage Data. Claims for AutoPASS OBU Customers' passages are then sent to the specific Toll Service Provider.

The other main entity that is part of this specification is the Monitoring and Control System (MCS). The MCS is used for automatic monitoring, control of, and for maintaining the Charging Point Equipment. The MCS shall also offer a service to be used by the Customer and Toll Charger for monitoring and controlling the Charging Point Equipment.

The information provided in the interface shown in Figure 3 above is split into the types listed in 1. The full details and format of the data exchange is covered in the interface specification **SSA-T Appendix 1 annex 6**. Figure 3 is applicable when there is more than one CP in the Toll System. Should the Toll System only consist of one CP a Data Concentrator may be a part of the equipment located at the CP.

Table 2 Brief description of the data content in the information flow between the TC's CS and CPE.

Type	Overall description	Information flow	General description
Payment Related Data	Covers information about the validity of the OBU and OBU Toll Service Providers that supports the system.	AIT File	List of OBU Toll Service Providers that are accepted within the AutoPASS system
		OBUS Statuslist	Basically a whitelist that gives status about the On Board Unit and is mainly used for signalling to the AutoPASS OBU Customer if his/hers OBU is valid balance is low. In addition it contains specific actions like if Vehicle Images shall be collected when the OBU passes the Charging Point.
		OBUS Blacklist	List of the On Board Units that are blacklisted within the EasyGo agreement.
	Used for displaying actual tariff at roadside	Price File	Covers information about the toll for each of the CP lanes, taking date, day, time and the different vehicle classes into account.
Vehicle Passage Data	Covers information about the passage at the CP.	Passage	Detailed information about the passage.
		Vehicle Image(s)	JPEG compressed Vehicle Images for the vehicle passage. Mainly used for charging by LPR.
Monitoring and Control	Equipment alarms	Alarm Message	Report and distribute an alarm message detected in the toll system.
	Equipment/system information	Exception Message	Report of an exception detected at the roadside.

Further details about the Alarm and Exception Messages are found in Appendix 1 Annex 6.

5.4 User Characteristics

Four distinct groups of users exist for the Charging Point Equipment system:

- The AutoPASS User, where there are two main categories:
 - AutoPASS OBU Customer
 - AutoPASS Customer
- The Toll Charger which shall be able to monitor the Toll System, eventually several different toll systems.
- The Customer that shall be able to monitor the Toll System.
- The Toll Charger's Central System which shall be able to upload/download data to the Charging Point Equipment

5.5 AutoPASS Users Payment Methods

The automatic Charging Points offers the AutoPASS User the payment alternatives presented in Table 3.

Table 3 Payment methods for automatic Charging Points

Payment method	Description
Electronic Fee Collection	This payment method applies for all AutoPASS OBU Customers. The AutoPASS OBU Customer pays for his passages according to a contract with an AutoPASS/EasyGo Toll Servicer Provider.
Charging by LPR	<ul style="list-style-type: none"> ○ If the vehicle has a valid contract with a TSP or a local TC, The AutoPASS OBU Customer pays for his passages according to a contract with an AutoPASS/EasyGo Toll Servicer Provider. ○ If no valid contract, payment in arrears can be fulfilled in the following way: the Toll Charger sends an invoice for the passage to the owner of the vehicle (identified by the images of the vehicle's Licence Plate Number)

5.5.1 Electronic Fee Collection

An AutoPASS OBU Customer is subjected to payment via a Central Contract.

The AutoPASS OBU Customer's OBU is validated based on three lists transferred to the CP, the three lists are elaborated in Table 4 below and in Appendix 1 Annex 6.

Table 4 OBU validation lists

List type	Functionality
AIT file	This is a register where all authorized EasyGo Toll Service Providers (Issuers), including AutoPASS (Issuers) are defined with relevant information about the OBUs issued by the Toll Service Providers. This includes issuer identification in the OBU ID, contract type information, etc. Exchange of AIT file is not scheduled on a periodic basis, but is carried out when there are changes related to the Toll Service Providers.
OBU Statuslist	OBU Statuslist holds information about all OBUs with a valid Norwegian AutoPASS contract. In addition the OBU Statuslist contains information of all foreign OBUs with valid EasyGo contracts registered for Heavy Goods Vehicles (heavy vehicles larger than 3500 kg) which makes it possible to perform correct classification of these vehicles. At least once per 24 hours an updated OBU Statuslist is distributed to the CPE.
OBU Blacklist	The OBU Blacklists contains invalid EasyGo contracts. Norwegian OBUs are validated from the OBU Statuslist. At least once per 24 hours an updated OBU Blacklist is distributed to the CPE.

5.5.2 Charging by LPR

An AutoPASS Customer is subjected to charge by LPR when passing an CP. When the vehicle passes the charging area, the charging point take images of the vehicle at least of the front and the rear license plate, with the exception that rear vehicle images is not collected in the case that the vehicle is pulling a trailer.

The Vehicle Images are then analysed automatically by the CPE for determination of the vehicle's License Plate Number (LPN).

The outcome of reading each Vehicle Image is basically dependent on the confidence level, and shall for each Vehicle Image be:

- The Vehicle Image contains no vehicle LPN. The reason for this may be poor image quality, the vehicle license plate is obscured or missing.
- The analysing process has found an LPN. The result of the LPN reading including the LPN nationality and confidence level are written in the Passage.

The applicable data fields for this are given in Appendix 1 Annex 6.

5.6 Monitoring and Control System

The Monitoring and Control System (MCS) will give the ability to centralise monitoring and control for all Charging Points in a toll system, independent of the original supplier. The MCS will at least cover all types of Charging Points delivered by the Contractor in a toll system.

The MCS will present the various events and states in the CPE system and allow qualified staff to control operation and behaviour of the CPE system. The MCS will produce and transfer reports, statistics, exceptions and alarms regarding TC operation both automatically and on demand. It will also transfer data to a 3rd party MCS (global MCS for the TC operator).

The Monitoring and Control System will allow for that it can be:

- Used locally at the Charging Point for testing/maintenance purposes,
- Used at a Monitoring and Control Centre (MCC),
- Accessed remotely by the Toll Charger and the Customer.
- Monitor continuously, every hours and days with fee collection.

5.7 Charging Point Construction

This specification covers separate, but also toll systems that are formed either as toll cordons or distance based toll systems (to the right of Figure 4). A system may include more than one cordon combined with separate Charging Points. The toll may apply in one or both directions at the Charging Point.

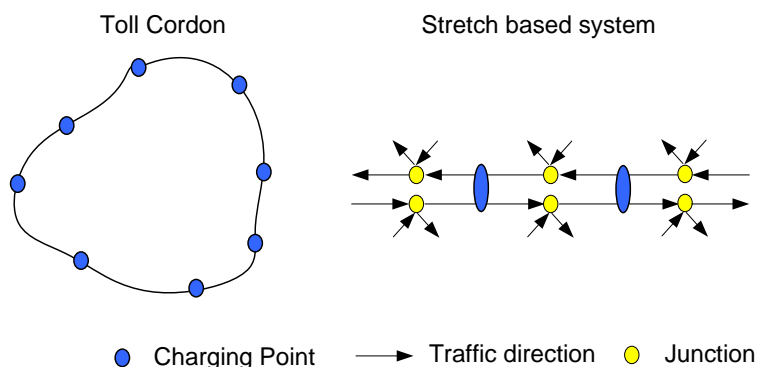


Figure 4 Toll cordon and distance based systems

The Charging Point shall send information so that the deduction of the toll can take place at the Toll Charger. I.e. it shall be possible for the Toll Charger to deduct the toll for a specific AutoPASS User based on the collected information in the Passage from the Charging Point.

The Charging Points can be of various types and can be collecting toll in one traffic direction or in both traffic directions. This Appendix with Annexes summarises the applicable configuration for the Toll System. Figure 5 gives an overview of some of the types of Charging Points that are covered by this specification.

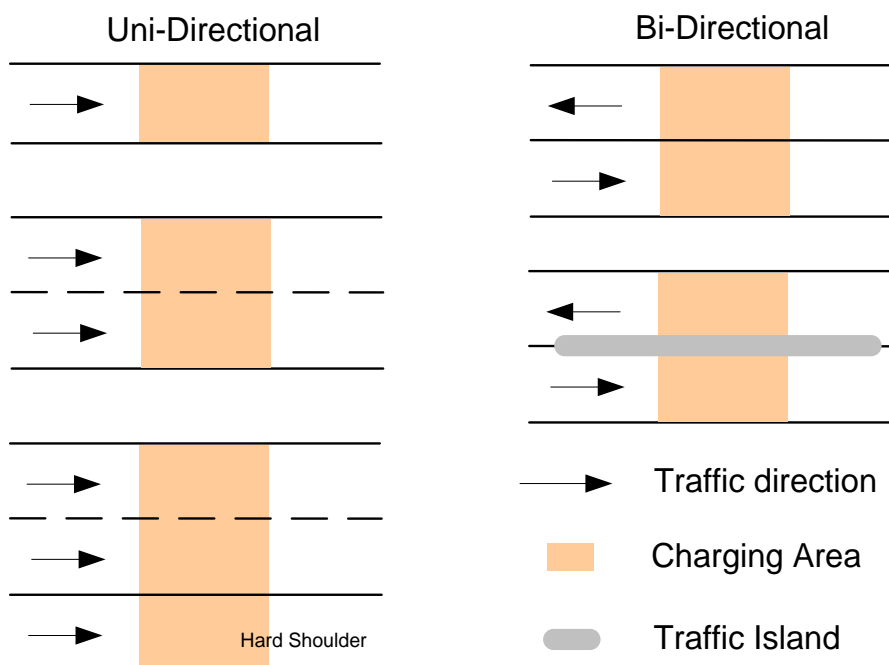


Figure 5 Various types of Charging Points covered by this specification.

In addition to the types of CPs shown in Figure 5 above, there might be combinations like:

- Two lanes and hard shoulder in each traffic direction. The traffic directions are separated with a road barrier. Toll may apply in one or both traffic directions.
- CP with two lanes in one direction and a Traffic Island separating traffic in the other direction. Toll may apply in one or both traffic directions.
- A CP on a bidirectional road where toll only applies in one direction.

- The CP may include separate lanes for tram, buses, bicycles and pedestrians.

If the type of Charging Point is as shown in the upper right part of Figure 5 vehicles trying to avoid the toll by passing in the lane for opposite direction, see Figure 6, shall also have the front and rear vehicle Licence Plate Number imaged. If the toll only applies in the vehicle's driving direction, it is sufficient to only have a front Vehicle Image. For such a passage in the lane for opposite direction the Charging Point normally does not have to communicate with the AutoPASS OBU Customer's On Board Unit, but OBU communication might be an option, see section 20.

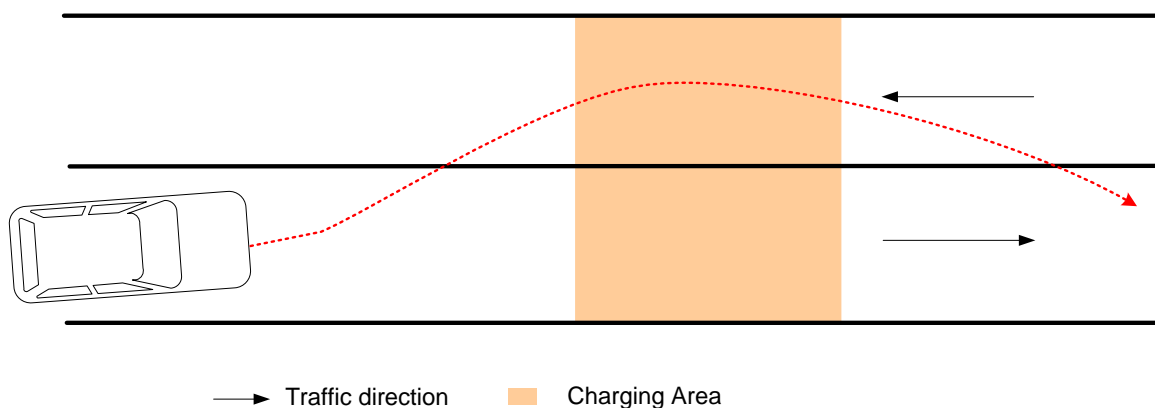


Figure 6 AutoPASS User trying to avoid the toll by passing in the lane for opposite direction.

5.8 General Constrains

The AutoPASS system is very critical with respect to fair treatment of AutoPASS Users, imposing high design demands on the system as to:

- A reliable solution, as erroneous decisions tend to result in for instance negative publicity in the media.
- Minimising the possibilities for the AutoPASS User to avoid paying the toll.

The statements above imply constraints related to:

- **System availability:** The system shall be designed to be highly available. This implies that the Charging Point shall be able to function in the following situations:
 - loss of power; calls for an independent power source (UPS) to bridge a short period of absence of utility main power supply.
 - loss of network connection to the Central System; calls for adequate local storage facilities that allow for buffering the data until the data can be retrieved.
 - component failure;
 - calls for adequate reporting of detected failure by the Monitoring and Control System, enabling the maintenance organisation to (locally or remotely) access the Charging Point and correct the failure.
 - the Charging Point has built in robustness so that a component failure does not necessarily have consequences for the tolling process.
- **Security:** Mechanisms shall exist within the system to prevent fraud of OBUs and tampering at the Charging Point.
- **Privacy:** Safeguard the AutoPASS User's rights to privacy.
- **System monitoring:** Malfunctions in the system shall automatically and effectively be reported to the maintenance organisation.

- **Preventive maintenance:** The system shall be designed such that the need for preventive maintenance, like periodic cleaning of equipment, is minimal.
- **Corrective maintenance:** The equipment shall be designed such that components can be easily replaced in the case of corrective maintenance.

5.9 Assumptions and Dependencies

The following assumptions and dependencies are made for this specification and are reflected in the requirements:

- The communication between the Charging Point and OBU shall be in accordance with AutoPASS DSRC specifications and as specified within the EasyGo agreement.
- The Charging Point is operating online connected to the Toll Charger's Central System. In the future to AutoPASS HUB.

Avoiding the toll by driving against road signs, on pedestrian or bicycle roads, on grass beside the road shall not be considered as passing the Charging Point. Some Toll Systems may specify exemption to this covering, such as the case of vehicles passing in the lane for opposite direction, cf Figure 6. Cf Appendix 1 Annex 1.

6. CPE USE CASE DIAGRAM

6.1 Use case for Charging Point Equipment

Figure 7 shows the main use cases for the Charging Point Equipment. The Actors are:

On the left side of Figure 7: The vehicle and the AutoPASS User being either an AutoPASS Customer or an AutoPASS OBU Customer. For an AutoPASS OBU Customer the OBU is used for identifying the passage, and at a later stage for the Toll Charger to collect the toll from the Toll Service Provider.

On the right side of Figure 7:

- The Toll Charger's Central System that communicate with the Charging Point Equipment within the Toll System.
- The System User which can be a Maintainer, Toll Charger or the Customer that monitor, controls and/or maintain the system.

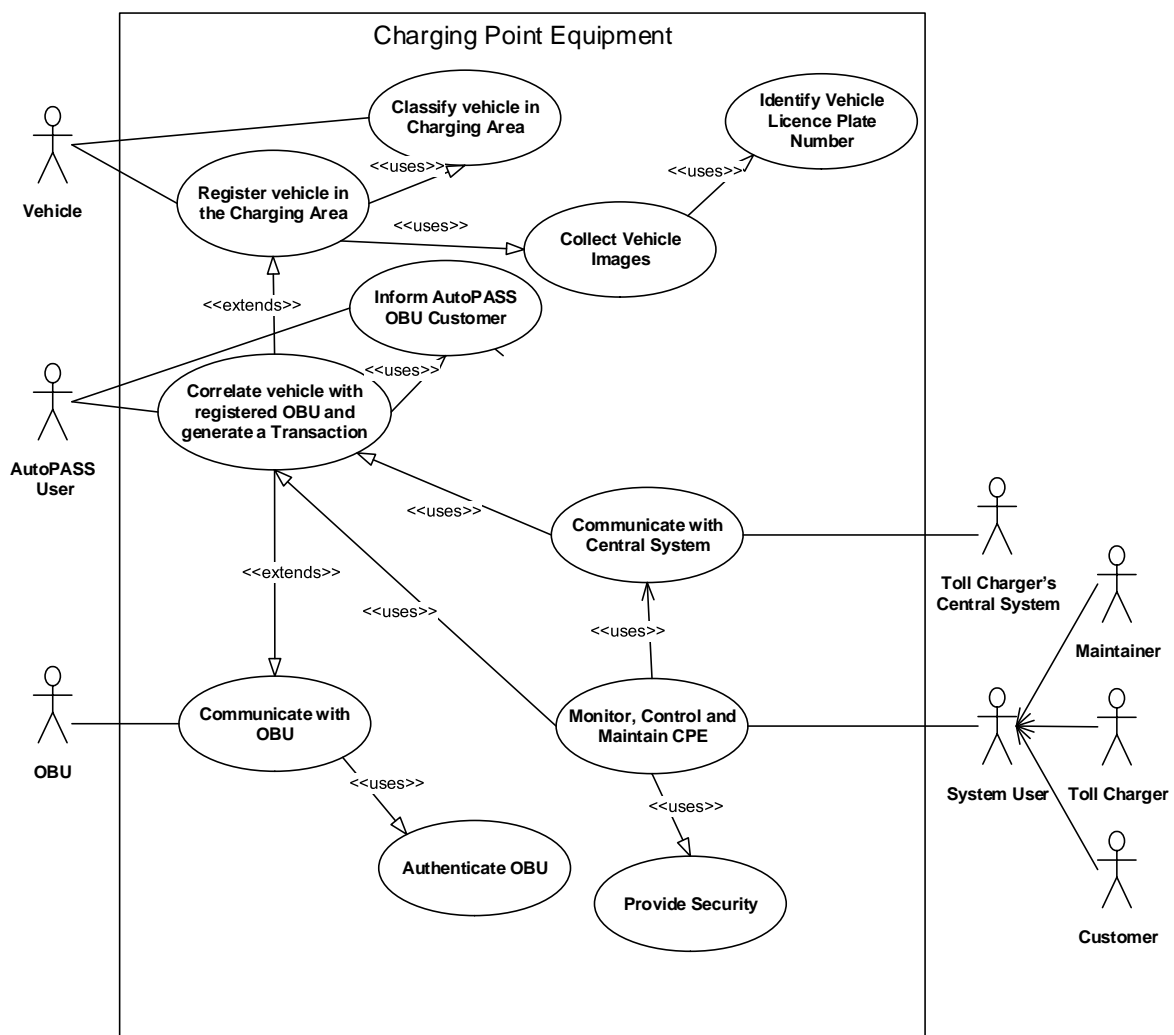


Figure 7 CPE Use case diagram

The following sections describe the use cases in more detail.

6.2 Use cases

6.2.1 Vehicle related

Register Vehicle in the Charging Area

Purpose	To detect any object in the Charging Area that could be classified as a vehicle.
Overview	The Charging Point will constantly monitor the Charging Area by means of sensors to detect the presence of an object that is potentially subject to toll.
Actors	Object of any kind, e.g. pedestrians, bikes, cars, motorcycles and trucks.
Triggers	Any object detected by a sensor monitoring the Charging Area.
Description	<ol style="list-style-type: none"> 1) The CP monitors the Charging Area. 2) The CP registers the detected object

Classify Vehicle in the Charging Area

Purpose	To measure the relevant physical parameters of a object.
Overview	The CP measures the physical parameters of the objects and report them in the Passage for payable objects.
Actors	Object of any kind, e.g. pedestrians, bikes, cars, motorcycles and trucks.
Triggers	Any object detected.
Description	<ol style="list-style-type: none"> 1) The CP collects information about the object in the Charging Area. 2) The CP checks the physical parameters and filters objects not being subject to toll. Objects not filtered are assumed to be vehicles.

Collect Vehicle Images

Purpose	Exception Handling or charging by LPR are used to collect Vehicle Image(s) that identifies vehicle LPN.
Overview	The CP collect and stores front and rear Vehicle Images.
Actors	Object of any kind not filtered
Triggers	Any vehicle detected through the Register Object use case.
Description	<ol style="list-style-type: none"> 1) The CP uses Register Object use case to image the vehicle. 2) The CP stores the actual Vehicle Images.

Identify Vehicle Licence Plate Number

Purpose	To automatically read the vehicle's Licence Plate Number.
Overview	The CP identify and extract the vehicle's Licence Plate Number from the Vehicle Image.
Actors	Vehicle Image of any kind.
Triggers	Any Vehicle Image.
Description	<ol style="list-style-type: none"> 1) The CP uses the collected Vehicle Images in the Collect Vehicle Images use case to extract the vehicle's Licence Plate Number (LPN). 2) The CP stores the extracted LPN.

6.2.2 OBU related

Communicate with OBU

Purpose	Communicating with the AutoPASS User's OBU
Overview	The CP communicates with the OBU installed in the vehicle.
Actors	OBU.
Triggers	OBU entering the Charging Area.
Description	<ol style="list-style-type: none"> 1) The CP continuously sends a Beacon Service Table (BST). 2) The OBU entering the Charging Area responds with a Vehicle Service Table (VST). 3) The OBU and CP communicate according to the specific DSRC specification. 4) The CP stores the OBU retrieved data.

Authenticate OBU

Purpose	To authenticate the OBU. The CP has received the TSP's security keys needed for authentication if stated in the AIT file.
Overview	The CP communicates with the OBU installed in the vehicle and verifies that the OBU is authentic.
Actors	OBU.
Triggers	OBU entering the Charging Area.
Description	<ol style="list-style-type: none"> 1) The CP issues a command to the OBU. 2) The OBU respond to the command. 3) The CP verifies if the OBU is authentic. 4) Non-authentic OBU's are reported.

6.2.3 Payment related

Correlate vehicle with registered OBU and generate a Passage

Purpose	To enable payment for the vehicle passage when the system is in Charging State.
Overview	The CP correlate a physical detection with an OBU registration.
Actors	Vehicle of any kind.
Triggers	Any object detected and not filtered and connected to an OBU registration.
Description	Generate a Passage for the passage Store Passage and if applicable Vehicle Image(s).

Inform the AutoPASS Customer

Purpose	Giving the information required for the AutoPASS Customer.
Overview	The CP shall no longer communicate with the AutoPASS Customer by means of a status light (green /video) as indicated in the CP's OBU Statuslist for AutoPASS OBU Customers. The system shall be prepared to inform the AutoPASS Customer by sound (MMI).
Actors	AutoPASS Customer
Triggers	Any vehicle
Description	The CP gives feedback to the AutoPASS OBU Customer that passes the Charging Area by displaying the status related to the OBU Statuslist.

6.2.4 Maintenance and operation

Monitor, Control and Maintain CPE

Purpose	To monitor, control and maintain the functionality of the CPE. E.g. handle exceptions, alarms from the CPE, Control the CP Main State and maintain the CPE.
Overview	The CPE monitors its functionality and reports its status.
Actors	Users being the Toll Charger, Customer and supplier.
Triggers	Any errors detected by the CPE monitoring functions, a System User requesting status or reports related to the CPE or changing the Main State of the CP.
Description	1) The CPE monitors its functionality and reports on different levels to the System User, or 2) The System User interacts with the CPE and requests status, 3) The supplier interacts with the CP to resolve errors.

Provide security

Purpose	To protect the CP and the information stored at the CPE from unauthorised access.
Overview	The CP has mechanisms enabling a sufficient protection of CP and information stored by the CPE.
Actors	Supplier or Toll Charger.
Triggers	A person accessing the CPE or information stored by the CPE.
Description	<ol style="list-style-type: none"> 1) The supplier or Toll Charger user accesses the CPE or data stored by the CPE. 2) The CPE provides the required measures and mechanisms (both hardware and software) ensuring a specified level of security.

6.2.5 Communicate with Toll Charger's Central System (and later AutoPASS IP and HUB)

Purpose	To transfer data between the CPE and the Toll Charger's CS.
Overview	The CPE communicates with the Toll Charger's CS and vice versa and transfers data between the CPE and the Toll Charger's CS.
Actors	The Toll Charger's Central system or supplier.
Triggers	<p>Any data that according to CP Scheduler shall be transferred between the CS and CPE.</p> <p>A supplier requesting transfer of information between the CPE and the CS.</p>
Description	<ol style="list-style-type: none"> 1) The CPE and Toll Charger's CS monitors its time schedules for data transfer and starts the communication whenever needed; or 2) A Supplier requests data transfer between the CPE and the Toll Charger's CS.

7. CPE OVERALL SYSTEM REQUIREMENTS

AutoPASS Users

ID	Requirement
[R 1]	<p>The CPE shall handle two types of AutoPASS Users:</p> <ul style="list-style-type: none"> • AutoPASS OBU Customer: a user equipped with an AutoPASS or EasyGo compliant OBU with a valid Central Account subjected to toll by EFC. • AutoPASS Customer: Non-OBU equipped or user with a non-compliant/invalid OBU subjected to charging by LPR.

7.1 Charging Point Main States

ID	Requirement
[R 2]	<p>The Charging Point (CP) shall have the three Main States:</p> <ul style="list-style-type: none"> • Charging: All functions of the CP are active. Payment Related Data, Vehicle Passage Data and Monitoring and Control Data shall automatically be collected, received and sent from the Charging Point to the Central System. • Stand-By: All payment related functions is deactivated. Payment Related Data, Monitoring and Control Data shall be collected, received and sent from the CP. Buffered Vehicle Passage Data shall be sent. • Off: All payment related functions is deactivated. No data shall be sent from the CP.
[R 3]	<p>The CP shall automatically transfer from one Main State to another Main State caused by the following conditions (see Figure 8 and Table 5):</p> <ul style="list-style-type: none"> • Power-up: The CP receives Alternating Current (AC) power. • Fatal error: The CP experiences an unrecoverable error. • Price file: Toll period becomes (in)active. • AC power failure and UPS capacity near to end.
[R 4]	It shall be possible to force a CP into a specific Main state.
[R 5]	The CP shall transfer from one Main State to another Main State without damaging or deleting information.
[R 6]	Within the Charging State it shall be possible to set the CP in Spot Test Mode.

ID	Requirement
[R 7]	<p>The Spot Test Mode (random control) shall for a specific time period enable collection and viewing of Vehicle Images selecting among the Spot Test Criteria. The Spot Test may be activated for one or multiple lanes:</p> <ul style="list-style-type: none"> • All passing vehicles subjected to toll. • All detected objects. • Every Nth vehicle. • All vehicles of a specific vehicle class. • All vehicles with declared vehicle class “light vehicle” and a height above a certain limit and a width above a certain limit i.e. possibly being heavy vehicles. • All vehicles with different LPN in OBU Statuslist and Passage.

Table 5 Possible automatic Main State transition as presented in Figure 8 below.

Main State	Cause -> Main State			
	Power up (1)	Fatal error (2)	Price file (in)active(3)	Loss of AC and UPS capacity near to end (4)
Off	Stand-by	NA	NA	NA
Stand-by	NA	NA	Charging	Off
Charging	NA	Stand-by	Stand-by	Stand-by

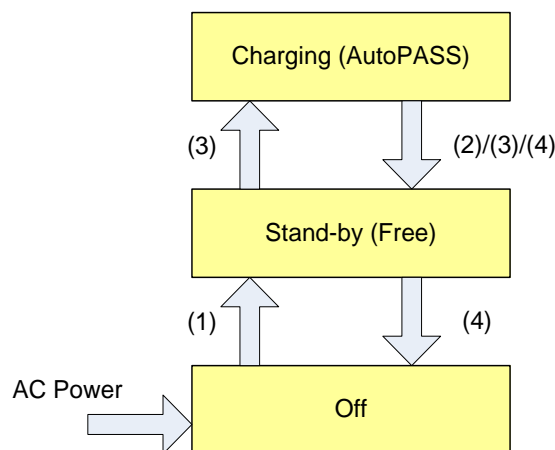


Figure 8 Charging Point Main States Terms in brackets are used in SSA-T Appendix 1 annex 6

7.2 CPE Configuration

ID	Requirement
[R 8]	At least the CP Configuration Data given in Table 6 shall be configurable for a single or all CPE's in the toll system.

ID	Requirement
[R 9]	The CP Configuration Data in Table 6 shall be automatically checked for the Contractor's defined allowable range.
[R 10]	Changing the allowable range for the CP Configuration Data parameters in Table 6 shall require a higher authorisation level than changing the value of the parameter.

Table 6 CP Configuration Data

Functionality	Parameters
Vehicle Image related	<ul style="list-style-type: none"> • JPEG compression degree • Gamma, Contrast, Black-level (Brightness) • Location of superimposed text information
Object Detection Threshold	<ul style="list-style-type: none"> • Criteria for detecting objects as vehicles
Exception Message	<ul style="list-style-type: none"> • Priority • Text • Code • Date, time • Source, receiver
CP Scheduler	<ul style="list-style-type: none"> • Configurable with respect to data transfer time for data to and from the Central System. • Configurable with respect to Vehicle Passage Data deletion time at the CP.
CP Identification	<ul style="list-style-type: none"> • Toll Charger (Operator ID) • CP number • CP Lane • Lane Identifier • Charging direction • Labelling of components (Sub unit identification)

7.3 CP Quality Indicators and CP Signal Code statistics

ID	Requirement
[R 11]	<p>For each CP there shall at a configurable period, be generated for each lane the following CP Quality Indicators:</p> <ul style="list-style-type: none"> • OBU registration: As a percent measured by number of vehicle passages with OBU to the total number of vehicle passages. • Average number of Vehicle Images for the vehicle passages. • Average confidence for the front and rear Vehicle Images respectively. • Number of vehicle passages. • Non-vehicle passages.

ID	Requirement
[R 12]	For each CP there shall continuously for each lane be generated data making it possible to register the percentage of all occurring Signal Codes to the total number of passages in the specific lane. Signal Codes are described in SSA-T Appendix 1 annex 6
[R 13]	The CP Quality Indicators and CP Signal Code statistics shall be kept for minimum a period of 2 years.

7.4 CP Logging

ID	Requirement
[R 14]	The CPE shall minimum log the following information: <ul style="list-style-type: none"> • Vehicle Payment Related Data transfer log with: time stamp, received file, errors detected. • Vehicle Passage Data transfer log with: time stamp, sent file, errors detected. • Exception Message log with time stamp. • System User log on/off with time stamp.

7.5 CP Scheduler

ID	Requirement
[R 15]	The CP Scheduler shall be configurable with respect to: <ul style="list-style-type: none"> • time of day, weekday, date and seasonal holidays. • setting to be repetitive or single running.
[R 16]	The CP Scheduler shall not be dependent on external communication in order to start or stop the task execution.
[R 17]	The CP Scheduler shall generate an Exception Message when starting and stopping.
[R 18]	The event resulting from successfully execution of a task of the CP Scheduler shall in the Exception Message have the priority 'information'.

7.6 CP Reconciliation Counters

ID	Requirement
[R 19]	The CP shall for each lane at the Charging Area have counters for reconciliation for detected vehicles. The reconciliation counters are transferred in the Passage as described in SSA-T Appendix 1 annex 6

8. CPE CAPABILITY REQUIREMENTS

8.1 Register vehicle in the Charging Area

ID	Requirement
[R 20]	<p>The CPE shall register the vehicle subjected to toll within the Charging Area, this includes vehicles driving between the lanes or on the hard shoulder. See Figure 5. There shall be one and only one registration for each vehicle passing the Charging Area.</p> <p>Objects not identified as a vehicle subjected to toll are for example; motorcycles, bicycles, persons and animals. These objects shall be discarded and there shall be generated an exception message for these objects with the reason for discarding. Small vehicles shall be registered and because of that, we accept that some large motorcycles might be registered as a vehicle.</p>
[R 21]	The CPE shall register vehicles that are in the Charging Area irrespectively of whether they are driving particularly fast, very slowly or in a stop and go environment (queue).
[R 22]	<p>The CPE shall detect and report a vehicle subjected to toll that is passing in the lane for traffic in the opposite direction. The identification shall be done either by OBU reading or video image.</p> <p><i>Any requirement for detection in opposite lane is specified in SSA-T Appendix 1 annex 1</i></p>
[R 23]	The CPE shall separate between two vehicles that are driving with a separation distance of more than 0.7 meter (along driving direction and across driving direction).
[R 24]	The CPE shall detect the presence of a trailer.
[R 25]	The CPE shall detect the driving direction of the vehicle and combine the Passage with the Vehicle Image(s).

8.1.1 Classify vehicle in Charging Area

ID	Requirement
[R 26]	The CPE shall collect parameters for possible vehicle classification. The classification shall be based on two or more of the following parameters: height, length or width.
[R 27]	A vehicle with a trailer shall be classified as one vehicle and the presence of a trailer shall be part of the classification data in the Passage as described in SSA-T Appendix 1 annex 6

8.1.2 Collect Vehicle Images

ID	Requirement
[R 28]	The CPE shall take at least one front and one rear Vehicle Image and the Vehicle Images shall be combined with the Passage. The format is described in SSA-T Appendix 1 annex 6 .
[R 29]	The Vehicle Image shall have superimposed text with the reason for taking the image.
[R 30]	The superimposed text for charging by LPR shall take precedence over text for Spot Test Mode.

ID	Requirement
[R 31]	<p>For vehicles passing in the opposite direction of the charging direction, the CPE shall:</p> <ul style="list-style-type: none"> • Take at least one front and one rear Vehicle Image when toll applies in both directions. • At least take a front Vehicle Image when toll applies in the vehicle's driving direction. • If opposite lane is equipped with OBU reader, vehicles with OBU's shall be identified by OBU reading and normal signal codes shall be used.

8.1.3 Identify vehicle Licence Plate Number.

ID	Requirement
[R 32]	The CPE shall automatically read the vehicle Licence Plate Number and nationality from the Vehicle Image.

8.2 Communicate with OBU

ID	Requirement
[R 33]	<p>The OBU communication within the CP's Charging Area shall comply with the EasyGo interoperable services and complete communication with the specific OBU shall take place once within the Charging Area for the following types of OBUs:</p> <ul style="list-style-type: none"> • AutoPASS OBU as specified in SSA-T Appendix 1 annex 8 • EN 15509 OBUs as specified in SSA-T Appendix 1 annex 7
[R 34]	<p>The CPE shall communicate with an OBU entering the Charging Area even if the corresponding vehicle has not been detected.</p> <p>If the system matches two or more OBUs within the same detection the most valid OBU shall generate a Passage. The other OBUs shall generate an exception message, including the OBU/PAN id. There shall be only one Passage for each detection.</p>

8.3 Authenticate OBU

ID	Requirement
[R 35]	The authentication of the OBU shall be in accordance with the requirements in SSA-T Appendix 1 annex 5
[R 36]	The CPE shall include a secure module (HSM) for storage and handling of cryptographic keys. The HSM shall conform to the functional and security requirements specified in SSA-T Appendix 1 annex 5

8.4 Correlate passage and store payment information

ID	Requirement
[R 37]	The CP shall handle the passage cases in accordance with Table 7. The signal code to be written in the Passage is specified in SSA-T Appendix 1 annex 6 . Vehicle Image of a trailer should not be included.

Table 7 Passage cases

Case	Vehicle	OBU present	Comment
Charging by LPR	Yes	No	Passage with front and rear Vehicle Images. Vehicle Images are read and LPN and nationality identified.
EFC	Yes	One OBU	EFC Passage. Vehicle Images are collected if instructed in the OBU Statuslist or from Spot Test Mode.
EFC special case	Yes	More than one OBU	One of the OBU shall result in an EFC Passage with Vehicle Images only if instructed in the OBU Statuslist. Other OBUs shall result in Exception messages. See requirements in SSA-T Appendix 1, Annex 2
EFC special case No vehicle	No	One or more OBU	Passage with description "signal code" indicating the situation. See requirements in SSA-T Appendix 1, Annex 2 .
Driving in lane for opposite direction	Yes		Passage with front and if applicable rear Vehicle Image with signal code indicating the situation. If a lane is equipped with OBU reader, identification may be done by OBU reading.

8.5 Feedback to AutoPASS User

ID	Requirement
[R 38]	N/A
[R 39]	N/A
[R 40]	N/A
[R 41]	The CP shall support the use of Feedback via sound signal in the OBU (MMI).
[R 42]	It shall be possible to turn on/off the signal functionality at each separate CP.
[R 43]	N/A
[R 44]	N/A
[R 45]	N/A

8.6 Communicate with Toll Charger's Central System

ID	Requirement
[R 46]	The CPE shall communicate with the Toll Charger's CS in accordance with SSA-T Appendix 1 annex 6 .
[R 47]	The CPE shall validate the Payment Related Data files from Toll Charger's CS with respect to: <ul style="list-style-type: none"> • Toll Charger (Operator ID). • File name. • Date and time. • Increment in sequence number. • Check of record lengths. • Check of control record if present.
[R 48]	If the validity check fails the CPE shall generate an Exception Message/alarm with the cause of the failure. The file shall not be accepted by the CPE.

8.7 Maintenance and operation

8.7.1 Monitor, Control and Maintain CPE

ID	Requirement
[R 49]	The CPE shall measure the quality of the Vehicle Images and send automatically an Exception Message when the measured quality of the Vehicle Images is below a critical level defined by the MCS.
[R 50]	The CPE shall generate Exceptions and send Messages at least for the types given in Table 8 below.
[R 51]	N/A

Table 8 Charging Point status and exceptions

Type	Status	Event/Exeptions
Power supply	Mains supply present/On UPS	On Uninterruptible Power Supply
Cabinet door	Open/Closed	When Opened
Roadside enclosure temperature	Value	Too low/Too high
Disk usage	Free space	Too low
Time synchronisation	Time Server name	When not connected to time server
CP Master Clock Battery	Functioning/non-functioning	When failure on CP Master Clock Battery
Charging Point System State	Charging/Stand-by/Off	When changing status
Charging Point Overall Status	Functioning/non-functioning	When non functioning
Charging Point VMS	Functioning/non-functioning	When non functioning
Charging Point TCP/IP Network	Functioning/non-functioning	When non functioning
Vehicle Image quality	OK/Not OK	When below a defined threshold read rate over a configurable period.
Information about at least the following sub-systems/equipment representing the following functionality: <ul style="list-style-type: none"> • DSRC Equipment including HSM • Equipment for imaging the vehicle • Vehicle Detection and Classification • Correlation between vehicle and OBU 	<ul style="list-style-type: none"> • Software version • Operative/Not Operative • Last restarted 	When non functioning or in degraded mode.

Type	Status	Event/Exeptions
Payment Related Data received from Central System: <ul style="list-style-type: none"> • Price file • OBU Statuslist • OBU Black List • AIT file 	<ul style="list-style-type: none"> • File name. • Date and time received. • Increment in sequence number. • Check of record lengths. • Toll Charger (Operator ID). • Check of control record if present. 	<ul style="list-style-type: none"> • When error in received file. • When not received in accordance with scheduler.
Context mark list	<ul style="list-style-type: none"> • List all context marks 	<ul style="list-style-type: none"> • By request
Vehicle Passage Data to be sent to Central System: <ul style="list-style-type: none"> • Passage File • Vehicle Image File 	<ul style="list-style-type: none"> • Last sent file • Date/time sent • Sequence number (if present) • Number of records 	<ul style="list-style-type: none"> • When Vehicle Passage Data not transferred within a configurable time with 48 hours as default • When Vehicle Passage Data deleted prior to transfer to CS

8.7.2 Provide security

ID	Requirement
[R 52]	The roadside enclosure at the CP shall be equipped with a sensor that detects the position (open/closed) of the roadside enclosure door
[R 53]	Logging on/off by a System User shall be logged.

9. CP PAYMENT REQUIREMENTS

9.1 General

ID	Requirement
[R 54]	<p>For vehicles subjected to toll the CPE shall take and store at least one front and one rear Vehicle Image under the following circumstances:</p> <ul style="list-style-type: none"> • Whenever the vehicle leaves the Charging Area without having completed a valid Passage by EFC. • When the OBU Statusfile requests collection of Vehicle Images for the specific OBU. • The CP is in Spot Test Mode and Vehicle Images shall be collected for the specific vehicle passage. <p><i>Note: Vehicle Image of a trailer should not be included.</i></p>

9.2 Electronic Toll Collection

ID	Requirement
[R 55]	<p>The DSRC Equipment shall be in conformance with applicable EU directives, see 4.2.3 including the Radio Equipment Directive 2014/53/EU..</p> <p><i>Note: See section 4.2.3 for further details about the directive.</i></p>
[R 56]	<p>The validation of the OBU, see Appendix 1, Annex 2 and 7, shall determine the behaviour regarding:</p> <ul style="list-style-type: none"> • validity of vehicle passage. • Sound signal (MMI) if required to give signal to the AutoPASS OBU Customer. • whether Vehicle Images shall be collected. • special information to be written in the Passage as specified in SSA-T Appendix 1 annex 6.
[R 57]	<p>The feedback to the AutoPASS OBU Customer shall when present:</p> <ul style="list-style-type: none"> • make it possible for the driver to easily observe the correct sound for his vehicle when driving through the Charging Area.

9.3 Charging by LPR and vehicle imaging

ID	Requirement
[R 58]	<p>Vehicle images shall be taken of all passages and processed with ANPR. Passages with valid OBU shall be checked against the corresponding Licence plate in the OBU Statuslist.</p>
[R 59]	<p>Passages with non corresponding Licence plate from the ANPR and OBU Statuslist shall have all images saved and transferred as other images. The passage shall be marked as described in SSA-T Appendix 1 annex 6. All other images from valid OBU passages shall be deleted within 500 ms.</p>
[R 60]	<p>Exposure time must be selected taking into account high vehicle speed. Fast driving must not result in unreadable images.</p>

ID	Requirement
[R 61]	<p>The resolution must be high enough to ensure high picture quality. The imaging sensor for the Vehicle Image shall give a resolution of more than 3 resolution elements over the thickness on the characters in the standard Norwegian vehicle LPN.</p> <p><i>Note: See illustration in Figure 9 below.</i></p>
[R 62]	Front Vehicle Images shall include the LPN as well as the headlights and a part of the vehicle enabling identification of vehicle type and make.
[R 63]	Rear Vehicle Images shall include the LPN as well as the rear lights and a part of the vehicle enabling assistance to identification of vehicle type and make.
[R 64]	Vehicle Images shall only cover the vehicle to be identified.
[R 65]	<p>The Vehicle Image shall be:</p> <ul style="list-style-type: none"> • JPEG compressed to a degree that does not reduce the possibility of successful reading. • Containing metadata and stored in a file with naming convention as defined in SSA-T Appendix 1 annex 6.
[R 66]	<p>The following text (metadata) from the Passage shall be superimposed on the Vehicle Image:</p> <ul style="list-style-type: none"> • Time (date and time including ms). Time shall be identical to time in Passage • CP identification. • Lane identification. • Serial number for the Vehicle Image. • OBU (On Board Unit) information (If applicable). • Signal Code. • Reason for the Vehicle Images with descriptive text from the Image Text File. <p><i>Note: The format is further described in SSA-T Appendix 1 annex 6 and exemplified in Figure 10 below.</i></p>
[R 67]	As default the superimposed text in the Vehicle Image shall be located in the obscured area - at the upper part of the Vehicle Image see Figure 10 below.

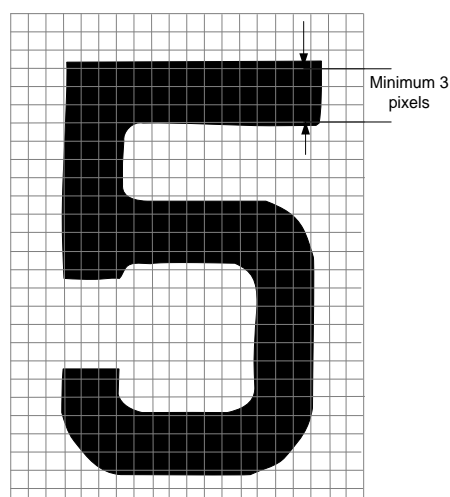
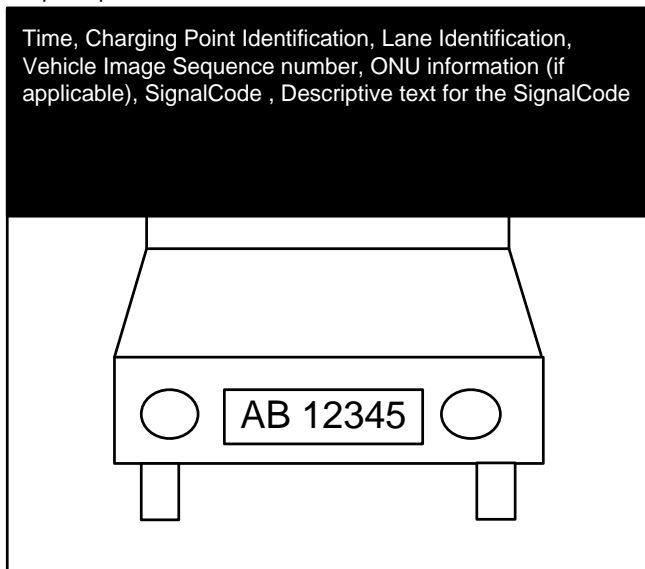


Figure 9 Vehicle Image resolution

Superimposed text in the obscured area

**Figure 10 Superimposed text in the Vehicle Image**

9.3.1 Automatic Number Plate Recognition

ID	Requirement
[R 68]	<p>The automatic number plate recognition functionality shall handle Norwegian and the pre-defined set of 11 nationalities, see table 9 below. Unsupported nationalities shall be tagged as "Possibly foreign".</p> <p>It shall be possible to deactivate/reactivate nationalities within the pre-defined set. The document SSA-T Appendix 1 annex 6 describes the requirements for mapping of the nationality within the Passage.</p>
[R 69]	<p>The Vehicle Images shall be analysed automatically and the following information shall be identified and included in the Passage:</p> <ul style="list-style-type: none"> • The LPN. • The nationality of the LPN. • A confidence level for the result (percentage from 0-100).

Table 9 Predefined nationalities (Alphabetic order)

Norwegian, Denmark, Estonia, France, Germany, Great Britain, Latvia, Lithuania, Netherland, Poland, Sweden

10. MONITORING DATA AND FUNCTIONALITY

10.1 Statuses and Alarms

ID	Requirement
[R 70]	The CP shall detect, time-stamp, categorise, log, translate and convey statuses and exceptions from CPE and network.
[R 71]	At least the statuses and exceptions presented in Table 8 above shall be reported from the CPE to the Monitoring and Control System and to the Toll Charger if requested.
[R 72]	Restart of systems or sub-systems shall: <ul style="list-style-type: none"> • set the status related to the equipment to 'unknown' until a proper confirmation of status has been obtained. • return the equipment to the applicable Main State of the CP.
[R 73]	Status of systems or sub-systems shall be verified as soon as the system is detected to be communicable.

10.2 Exception message

ID	Requirement
[R 74]	The Exception Message or Alarm shall have the different priorities: eg 'fatal', 'alarm', 'error message', 'warning' and 'information'.
[R 75]	An Alarm shall be transferred to the MCS within 15 seconds.
[R 76]	It shall be possible to set a minimum time interval that shall have passed before the same Exception Message is sent again.
[R 77]	Cascading of Exception Message as a consequence of one type of error triggering other error shall be prevented.

11. SECURITY REQUIREMENTS

ID	Requirement
[R 78]	All equipment storing Payment Related Data or Vehicle Passage Data shall implement access control mechanisms that prevent unauthorised access.
[R 79]	<p>The secure log-on routine shall:</p> <ul style="list-style-type: none"> • not show system or application IDs before the log-on routine is completed. • show a general warning stating that the equipment shall only be used by authorised personnel. • not provide any help informing what is wrong in the log-on procedure. • not make any of the log-on data available before completion of the log-on procedure. • after three failures of log-on set a time limit for the next possible log-on. • after a correct log-on show the time for last log-on and any attempts on log-on that failed.
[R 80]	Access control: The Charging Point Equipment (CPE) and the Monitoring Control System (MCS) shall have access control (no less than two-factor authorisation). Users shall be identifiable. Access should be controllable and limited to what is strictly necessary.
[R 81]	The CPE must have satisfactory information security. Encryption shall be implemented using widely known and recognised algorithms with sufficient key lengths.
[R 82]	Information security requirements must be possible to test, assess and evaluate on a regular basis, to ensure that satisfactory security is in place at all times.

12. PRIVACY

12.1 Data storage

ID	Requirement
[R 83]	<p>All Vehicle Passage Data for the vehicle passage shall be deleted from the CPE:</p> <ul style="list-style-type: none"> • When transferred from the CPE, configurable time, normally 72 hours. • When not transferred from data concentrator to the Toll Charger's Central System: configurable time period. <p>Validation lists shall automatically be deleted from CPE after a configurable time period.</p> <p>To maintain system performance the system shall have automatic mechanisms for increasing disk free space. Payment related data shall be secured during such an operation. When disk free space is less than 30% an exception message shall be generated. When less than 20 % and 10 % alarm messages shall be generated.</p>
[R 84]	<p>Vehicle Images shall not be stored for an EFC valid vehicle passage unless:</p> <ul style="list-style-type: none"> • Image taking is specified in OBU Statusfile • Vehicle Images are requested due to that the CP is in Spot Test Mode • The VLP in the pictures do not correspond with the LPN in the OBU Statuslist <p>If the CP is designed to temporarily take Vehicle Images even for EFC valid vehicle passage, the Vehicle Images shall be deleted immediately – no later than 500 ms..</p>

12.2 Masking of Driver/Passenger

ID	Requirement
[R 85]	<p>The front Vehicle Image shall have a non removable masked area covering the area where the driver and passenger may be located.</p> <p><i>Note: Figure 10 above shows an example of how the masked area may look like.</i></p>
[R 86]	<p>The masked area shall not cover areas of the front Vehicle Image that contains:</p> <ul style="list-style-type: none"> • The Vehicle License Plate. • Area of the front of the vehicle necessary to identify the vehicle type and make.

13. MONITORING AND CONTROL SYSTEM

13.1 General

ID	Requirement
[R 87]	The CPs shall be monitored through a Customer selected location for a common Monitoring and Control Centre (MCC) for all CP's in a toll system, at least all those delivered by the Contractor under this and other contracts in Norway. The MCC shall also include error-logs, service logs and exception messages and document events to calculate the Key Performance Indicators, see section 19.
[R 88]	Within the CPE's Virtual Private Network a workstation with suitable SW shall have access to the MCS.
[R 89]	The MCS shall perform a wide range of functions including at least: <ul style="list-style-type: none"> • Monitoring of CPE status, data exchange and network, • Receiving, processing and presenting Exception Messages and alarms, • Monitoring of Vehicle Passage Data, • Configuration of the CP Configuration Data, • Collect and present CP Quality Indicators and Signal Code statistics. • Collect and present the HW/SW components and their versions.

13.2 Access

ID	Requirement
[R 90]	Access to the MCS shall require identification by username and password.
[R 91]	The MCS shall have the configurable access levels for each Toll System given in Table 10. <i>Note: Access level can be assigned to various user groups like Toll Charger (Operator), Service & Maintenance, the Customer.</i>
[R 92]	All logon, successful or not, to the MCS shall be logged.
[R 93]	All operation performed on the Charging Point via the MCS shall be logged.

Table 10 Access level to the Monitoring and Control System

Access level	Required functionality
Low level	View information related to: <ul style="list-style-type: none"> • Exception Messages and status as given in 8, • View of CP Configuration Data, • View of the CP Quality Indicators, • View of Vehicle Passage Data.
Medium level	Low level functionality and: <ul style="list-style-type: none"> • Inspection of logs (see section 6.5 for minimum required logs)
High Level: Super User (Supplier)	Medium level functionality and: <ul style="list-style-type: none"> • Change of CP Configuration Data.

13.3 MCS User Interface

13.3.1 Overview

ID	Requirement
[R 94]	All user operations via the MCS User Interface (UI) shall give feedback to the user either by: <ul style="list-style-type: none"> • Confirming that the operation has been performed successfully, or • An error message describing the error and cause.
[R 95]	The MCS UI shall for all the Toll Systems delivered by the Contractor present: <ul style="list-style-type: none"> • an overview for each Toll System, • aggregated status for each Toll System.
[R 96]	The MCS UI shall allow selecting a specific Toll System.
[R 97]	For a specific Toll System the MCS UI shall present: <ul style="list-style-type: none"> • an overview of the CPs, • aggregated status for each CP.
[R 98]	The MCS UI shall allow selecting a specific CP within a Toll System.
[R 99]	The MCS UI shall present an overview of the CP and show the physical placement of the components at the Charging Point with the status of the component. <i>Note: This implies that the CP shall be visualised with the number of lanes and specific location of the components for the specific CP.</i>

13.3.2 Charging Point

ID	Requirement
[R 100]	For each CP the MCS UI shall display: <ul style="list-style-type: none"> • Which version of Payment Related Data that are in use and when the Payment Related Data became operative, • CP Configuration Data, see Table 6 above.
[R 101]	For a Super User the MCS UI shall allow changing the CP Configuration Data.
[R 102]	For a Super User the MCS UI shall allow for re-transfer of Vehicle Passage Data to the interface to the Toll Charger's Central System.
[R 103]	From the MCS UI it shall be possible to restart all critical CPE by: <ul style="list-style-type: none"> • Soft restart by accessing the specific equipment. • Cycling the powering from "off" to "on", on the relevant power circuit of the equipment.
[R 104]	The MCS UI shall provide an interface for a specific lane for viewing the last Vehicle Passage Data with Vehicle Images (if applicable).
[R 105]	The License Plate Number in the Vehicle Image shall be readable in the MCS UI without zooming.
[R 106]	Through the MCS UI it shall be easy to define levels for quality warnings with respect to Vehicle Image quality. The quality warnings shall be statistically based on continuous checking of the image quality for each separate lane.

ID	Requirement
[R 107]	For Spot Test Mode a user-friendly interface shall allow for changing the criteria for collection of Vehicle Image with respect to: <ul style="list-style-type: none"> • spot test on/off, • Spot Test Criteria.
[R 108]	The CP Quality Indicators shall in the MCS UI be displayed graphically and in table format for a time period covering both long-term (min 1 month) and short-term trends (min 12 hours) for all or selected lanes.
[R 109]	It shall be possible to select viewing the CP Quality Indicators for average configurable values.(e.g. 1 hour)
[R 110]	On request of viewing the CP Quality Indicators the result shall be provided within 10 seconds.
[R 111]	The CP Signal Code statistics shall in the MCS UI be displayed in table format for a selectable time period covering both long-term (min 1 month) and short-term (min 1 day) for the lanes at a CP.
[R 112]	Via the MCS UI the CP Quality Indicators and CP Signal Code statistics shall be downloadable.

13.4 Charging Point Equipment Status Summary

13.4.1 Status summary of Toll System delivered by the Contractor

ID	Requirement
[R 113]	The MCS UI shall allow for access and display of a common list of Exception Messages for the Toll System delivered by the Contractor, including eventually earlier delivered CP's in the toll system by the Contractor. Information within the Exception Messages may be brought up by a simple user interaction.
[R 114]	The MCS UI shall present the most recent Exception Messages collected from the Toll System delivered by the Contractor, including CP's in the toll system(s) delivered earlier by the Contractor in Norway.
[R 115]	For the common list of Exception Messages from all CP's delivered by the Contractor, the MCS UI shall: <ul style="list-style-type: none"> • as default only display Exception Messages with priority fatal and alarm, • allow for list of arbitrary selection of the Exception Message priorities, • allow for sorting of Exception Messages.
[R 116]	The MCS UI shall for a specific Toll System: <ul style="list-style-type: none"> • allow for filtering Exception Messages based on Exception Message priority, and • clearly indicate when such filtering of Exception Messages is active.

13.4.2 Status summary for a specific Toll System

ID	Requirement
[R 117]	The MCS UI shall for a specific Toll System present one list of Exception Messages including all message levels.

ID	Requirement
[R 118]	<p>The MCS UI shall allow for sorting the list of Exception Messages from a Toll System based on at least the following selection/sorting criteria:</p> <ul style="list-style-type: none"> • Message priority: an arbitrary selection of the priority. • Time interval: From date and time to date and time. • CPs: an arbitrary selection of CPs. • Unit type: an arbitrary selection of unit types. • Subunit type: an arbitrary selection of subunit types. • Lane: an arbitrary selection of lanes.
[R 119]	<p>The MCS UI shall for each CP within a Toll System at least display:</p> <ul style="list-style-type: none"> • Last transferred Vehicle Passage Data, • Payment Related Data version that are in use.

14. DESIGN AND CONSTRUCTION

14.1 General

ID	Requirement
[R 120]	<p>The CP shall be designed and constructed such that the following modifications can be performed:</p> <ul style="list-style-type: none"> • Expansion of lanes at the CP. • A change in Price file at the CP. • An extension or change in the supported OBUs for EasyGo. <p><i>Note: The applicable standards/directives for the extension of EasyGo are given in Section 4.2</i></p>
[R 121]	The CPE shall, including availability of functionally equivalent spare parts and consumables, have a lifetime that is at least corresponding to the term of SSA-V when maintained in line with the supplier specifications.
[R 122]	To reduce the need for cleaning to a minimum, the outdoor equipment shall have a design that avoids collection of dirt, snow, ice, water on the sensing surfaces.
[R 123]	The outdoor equipment shall with respect to design and colour be discreet and blend in with the environment at the CP location. The installation shall follow the NPRA regulations for safety in Håndbok R310 such as minimum heights and distances from hard shoulder for installed equipment.
[R 124]	Use of light sources at the CP shall not glare or in any other means disturb the drivers with a possible result of hazardous traffic situations.

14.2 Roadside Enclosure

ID	Requirement
[R 125]	The roadside enclosure shall be equipped with locks to all doors. Within Toll Systems supplied by the Contractor under this and other agreements, all locks shall use the same key.

14.3 Gantry Equipment

ID	Requirement
[R 126]	<p>Equipment mounted above the road shall be mounted such that the minimum headroom is 5.0 m</p> <p><i>Note: Any other headroom requirements are set out in SSA-T Appendix 1 annex 1</i></p>

15. CHARGING POINT EQUIPMENT AND RELATED INSTALLATION SERVICES

ID	Requirement
[R 127]	Contractor shall provide and install all necessary equipment included brackets and cables necessary for payment with EFC and video enforcement of vehicles passing in all lanes/areas described at the Charging Point.
[R 128]	Contractor shall provide all equipment necessary for video surveillance for the toll station. The camera detection area must be limited, either by software or hardware, to only cover the toll station area. Private gardens and private homes must not be visible. Video surveillance system shall have dome cameras, and shall be connected and operated from the monitoring system. The camera is for online lmonitoring of toll station area.. The cameras must at least cover the road in the toll station area, the technical booth/cabinet and at least one VMS if present.
[R 129]	CPE's shall be able to connect to the AutoPASS Network using a standard Ethernet cable. The telecommunication termination point in (or near) the technical booth (RJ45 std. Ethernet) will be provided by the Customer. The interface between the AutoPASS Network and the CPE will be the router (with Ethernet interface) delivered by the network service provider.
[R 130]	The Contractor shall facilitate the installation of telecommunication equipment. This equipment shall be powered by the same source as the CPE, which is the UPS.
[R 131]	Contractor's system shall support a backup communication solution with an automatic changeover to a wireless communication in case of loss of main communication.
[R 132]	The outdoor equipment delivered by the Contractor shall have a colour similar to the colour of the gantries and poles decided by the Customer if possible.
[R 133]	The Contractor is responsible to protect all cables from possible damages made by rodents. Cables shall be protected from destruction caused by vandalism or rodents, e.g. rats and mice, below the surface and up to 3.0 meter above the surface.
[R 134]	The Contractor shall follow the Customers specification of IP addresses for the network, including specification of ports for communication.
[R 135]	Contractor shall provide and install indoor cabinets for installation of Charging Point Equipment and the UPS where technical booths are used according to SSA-T Appendix 1 annex 1 . The cabinets shall have enough space for other necessary equipment (for example telecommunication equipment).
[R 136]	Contractor shall provide and install outdoor cabinets for installation of Charging Point Equipment and the UPS according to SSA-T Appendix 1 annex 1 . The cabinet shall have enough space for other necessary equipment (for example telecommunication equipment).
[R 137]	Outdoor cabinets shall be delivered with foundations according to SSA-T Appendix 1 annex 1
[R 138]	A connector for backup power generator together with a switchable contact shall be installed inside the cabinet by the Contractor.

ID	Requirement
[R 139]	Contractor shall select the type of cabinets to be used in co-operation with the Customer.
[R 140]	The doors must be prepared for locks of cylinder type. The Contractor shall deliver cylinder locks.

16. DOCUMENTATION

ID	Requirement
[R 141]	The installation shall be documented in accordance with Norwegian laws and regulations and standards (Elektroforskriften etc). The FebDoc file must be submitted electronically. The document delivery is part of the SAT.
[R 142]	If the Customer handles the order of the electrical supply, the Customer will deliver a FebDoc file that the Contractor shall calculate on.

17. TRAINING

ID	Requirement
[R 143]	The Contractor shall train the Customer, Users and Toll Charger in the use of the monitoring and control system

18. OTHER REQUIREMENTS

18.1 General provisions on external legal requirements and measures

Legal or party-specific requirements that are relevant to the execution and performance of the Agreement. The Contractor shall conform to the following rules and regulations

ID	Description
[R 144]	The Personal Data Act https://lovdata.no/dokument/NL/lov/2016-06-17-73
[R 145]	Regulations on the processing of personal data (Personal data regulations) http://lovdata.no/dokument/SF/forskrift/2000-12-15-1265
[R 146]	Transfer of Personal Data outside the EU/EEA requires additional safeguards. Some additional countries are defined as providing adequate protection – and should be considered as “within EU/EEA” in this context https://ec.europa.eu/info/law/law-topic/data-protection_en
[R 147]	The Contractor shall cooperate with the Customer regarding a SHE (SHA) plan.

	See SSA-T Appendix 06 Annex 2 – SHA plan
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18.2 Personal data

Customer's requirements to the processing of personal data:

ID	Description
[R 148]	Data processor agreement The Contractor shall sign a Data processor agreement with the Customer (SSA-T Appendix 12). The description of data processing, with requirements and obligations is described on: https://www.datatilsynet.no/English/

18.3 Electronic communication and processing requirements

Electronic communication or processing requirements:

ID	Description
[R 149]	Communication containing confidential information All communication containing confidential information shall be executed through encrypted channels, and with strong authentication. Confidential information includes: <ul style="list-style-type: none"> Information included in statutory and contractual confidentiality: <ul style="list-style-type: none"> Sensitive personal Information from the Personal Data Act Confidentiality Clauses; information of a sensitive nature where unauthorized access to the information can cause significant damage to individuals, the Customer, the contract party or their interests
[R 150]	Limitations The contractor shall not download, distribute or use information obtained from the Customer, without explicit consent from the Customer in each individual case.

19. OPERATIONAL REQUIREMENTS

Operational requirements are specified in Appendix 1 Annex 4.

20. LIST OF ANNEXES TO APPENDIX 1

Table 12 Annexes to Appendix 1

Annexes	Attached
Annex 1 – Charging Points	x
Annex 2 – 4.1 AutoPASS CPE signal codes	x
Annex 3 – AutoPASS Definitions and abbreviations	x
Annex 4 – Operational Requirements	x
Annex 5 – 4.5 Security Architecture for AutoPASS	x
Annex 6 – 4.3 AutoPASS Data Formats	x

Annex 7 – 4.7 AutoPASS EN15509 OBE – Functional and Technical requirements	x
Annex 8 – 4.2 AutoPASS Radio Link	x

Table 12 Annexes to Appendix 1