



AP-1.4

AutoPASS Processing of Signal Codes

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DOCUMENT STATUS

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Status	Version	Description
Final	4.0	Replaces version 3.0

REVISION HISTORY

Version	Date	Author	Comments/amendments
1.0	20.06.2017	NPRA	Original document "4.1 Processing of Signal Codes"
2.01	13.04.2021	NPRA	Relabelled the document to AP-1.4. Signal codes 21, 33, 35 and 36 added. Signal code 19 modified.
3.0	02.08.2021	NPRA	Added detailing of SC 21 – requirement for matching ANPR from front and rear images.
4.0	04.07.2023	NPRA	Redefined MMI in table 1. Other minor clarifications.

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1. PREFACE

1.1 Objectives

This document provides a detailed specification of the passage handling logic to be implemented in all CPE in AutoPASS Samvirke. Common principles for the determination of different passage signal codes are necessary in order to handle transactions in a uniform way in the various back-office systems, independent of the supplier and type of CPE.

This specification is aimed at all actors including their subcontractors/suppliers that are handling transactions in AutoPASS Samvirke.

1.2 Referenced Documents

The following table lists the documents that are referenced in this document:

Ref.	Document Title	Description
1.	AP-1.0 AutoPASS Definisjoner, Standarder og Direktiver	Lists and describes all concepts, definitions, standards, and directives that are relevant for the specifications of AutoPASS Samvirke.
2.	AP-1.5A Overordnet kravspesifikasjon for AutoPASS vegkantutstyr	General requirements for roadside equipment.
3.	AP-1.5B Detaljerte krav til AutoPASS vegkantutstyr	Detailed requirements for roadside equipment.

1.3 Concepts, definitions, standards, and directives

For concepts, definitions, standards, and directives, please see ref. [1]

Ref. [2] outlines the purpose and guidelines for the technology and operation of roadside equipment.

Detailed requirements for the roadside equipment can be found in ref. [3]

2. SIGNAL CODES

Signal Codes (SC) describe the type of transaction as a result of the processing of the passage in the CPE. The CPE uses the vehicle detection and the processing according to the flow chart in [Figure 1. Flow chart of CPE logic.](#)

Signal codes to be used in AutoPASS automatic tolling stations are listed below in [Table 1. Overview of Signal Codes.](#) Legacy/obsolete Signal Codes are not included in the table.

Table 1. Overview of Signal Codes

Code	Image	MMI (*)	Description	Basis for Charge (Assigned by AP-IP)
02	No	255	Approved passage with OBE	OBE
08	No (*)	255	Passage with valid OBE but without corresponding vehicle detection.	OBE
19	Yes	255	Passage with valid OBE but there is also another approved OBE passage (with SC02) associated with the same vehicle detection. (There are probably more than one OBE with valid contract in the same vehicle).	No charge
21	Yes	255	Passage with valid OBE in OBU StatusFile where there is mismatch between LPN in the OBU StatusFile versus the result of ANPR from the roadside. Signal Code 21 is only to be used when the ANPR results from the front and rear images match.	Video Enforcement
22	Yes	n/a	Passage without detected OBE or an illegal OBE type (EFC Context Mark (EFC_CM) is not approved).	Video Enforcement
23	Yes	1	Passage with OBE not defined in OBU StatusFile.	Video Enforcement
25	Yes	2	Passage with legal OBE type but authentication failed.	Video Enforcement
26	Yes	2	Passage with legal OBE type but access credential check failed.	Video Enforcement
33	No (**)	1	(«Shadow SC» to SC23) OBE passage without vehicle detection and with OBE not defined in OBU StatusFile	No charge (**)
35	No (**)	2	(«Shadow SC» to SC25) OBE passage without vehicle detection and legal OBE type, but authentication failed.	No charge (**)
36	No (**)	2	(«Shadow SC» to SC26) OBE passage without vehicle detection and legal OBE type, but access credential check failed.	No charge (**)
40	No	255	Passage in lane in mode "free of charge".	No charge
42	Yes	n/a	Passage in lane without OBE reader. To be used for passage in bus-bay or opposed lane.	Video Enforcement

(*) Explanations of MMI (Man-Machine Interface) codes that are sent from CPE to OBE to give audible feedback to driver about the result of the processing of the passage:

- 0 = OK
- 1 = Not OK
- 2 = Contact Service Provider
- 255 = No Signalling

(**) Assumed that a picture is not available. Should there however be images available that can be linked to OBE readings even where there is no vehicle detection, these images shall be included in the transactions.

3. SIGNAL CODES-PROCESS DIAGRAM

3.1 Flow chart

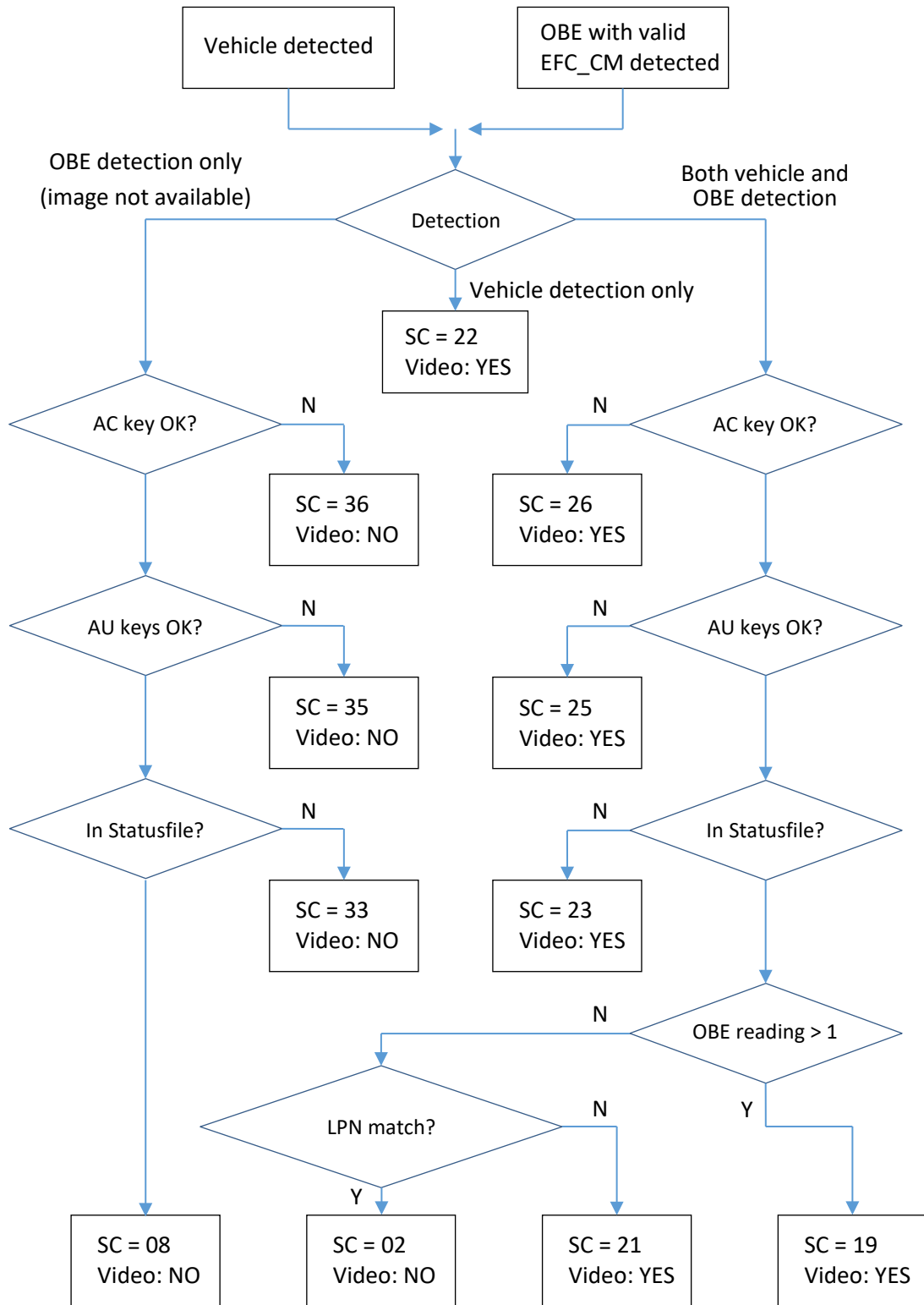


Figure 1. Flow chart of CPE logic

3.2 Explanation of flow chart

The diagram in Figure 1 shows the different verifications to be done to determine the signal codes and video enforcement of a passage. CPE Supplier should implement logic in CPE that is consistent with this diagram.

CPE Suppliers may use different technology in their CPE equipment, especially when it comes to vehicle detection systems. The basic principle in the diagram is that both the OBE reader (antenna) and a vehicle detection system can trigger the processing of a passage. If there is an OBE detection there is normally also an associated vehicle detection, and the rightmost path of the flow chart shows the logic in this situation.

It is assumed in the diagram that only a vehicle detection triggers the video system to capture pictures (front and rear) of the vehicle. In some (often but not necessarily faulty) situations an OBE detection has no corresponding vehicle detection, and pictures are not available. An OBE reading without an associated vehicle detection should be accepted and will undergo the same verifications as if it was a normal OBE passage with both vehicle detection and OBE reading (ref. leftmost path of the flow chart). However, different signal codes will indicate whether pictures are missing.

(*) Explanation of check "OBE reading > 1" in flow chart:

Quite often, it occurs that there are more than one valid OBE in a vehicle. A basic principle is that there should never be more than one accepted "normal" OBE passage (with SC02) when there are more than one valid OBE in a vehicle. Therefore, it is checked whether the same vehicle detection is likely to also be related to a previously processed and accepted OBE reading. In this case, subsequent accepted OBE readings shall be assigned signal code SC19, and images shall be included to be able to verify or disprove the presence of multiple OBE in one vehicle. To avoid possible multiple charge of the passage the post processing of the passages in AutoPASS IP must then check the detection counter ("SeqEntryDetection") in the transaction record and discard transactions that have the same value in this field.

One of the signal codes in Table 2 does not appear on the flow chart, and that is SC42 to be used for passage in bus-bay or opposed lane. Figure 2 describes this situation, and this should be handled in the same way as a SC22 passage, i.e. with a corresponding video picture.

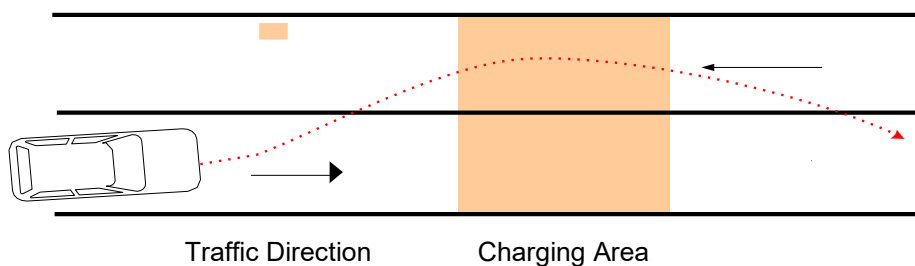







Figure 2. Signal Code 42 case

4. SIGNAL CODES OVERVIEW

The following signal codes may occur when processing is triggered by the vehicle detection system and/or the OBE reading:

Table 2. Possible Signal Codes dependent of source of passage triggering

OBE	Detection system	Antenna system	Possible Signal codes	Comments
1 	OK	OK	02, 21, 23, 25, 26	Reading of legal OBE type in AutoPASS with a corresponding vehicle detection.
2 	Not OK	OK	08, 33, 35, 36	OBE will have no matching vehicle detection.
3 	OK	Not OK	22, 42	Either a vehicle with no OBE, - or an OBE may be detected which is not of legal type in AutoPASS and therefore not processed. SC42 is passage in bus-bay or opposed lane.
4 	OK	OK	<u>OBE 1:</u> 02, 21, 23, 25, 26 <u>OBE 2 and any following OBE:</u> 19, 23, 25, 26	As SC02 passage one should select the first processed valid OBE.
5 	Not OK	OK	<u>All OBE:</u> 08, 33, 35, 36	Multiple OBE in one vehicle without a corresponding vehicle detection will result in OBE transactions with neglectable time difference. A filter should check this and write off the second OBE passage.