AP-1.4
AutoPASS
Processing of Signal Codes

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DOCUMENT STATUS

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Status	Version	Description
Final	3.0	

Document Version log

The purpose of the document version log is to describe the development of the document including the changes.

Version	Date	Author	Comments/amendments
1.0	20.06.2017	NPRA	New document "4.1 Processing of Signal Codes"
1.1	27.02.2018	NPRA	Signalcode 21 added. Changed colour for signalcode 10 in OBE validation
1.2	04.01.2020	NPRA	Removed Pista and old Brobizz from table and figure. Marked obsolete signalcodes and removed videoflag.
1.9	15.06.2020	NPRA	Renamed from 4.1 Processing of Signal Codes to AP-1.4 Processing of Signal Codes. Major changes. Introduction of new SC 33,35,36 and new use of SC19.
2.0	24.11.2020	NPRA	Minor correction (OBU->OBE) after consultation hearing with RBPS
2.01	13.04.2021	NPRA	Version for publication
3.0	02.08.2021	NPRA	Added detailing of SC 21 – requirement for matching ANPR from front and rear images.

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THE OBJECTIVES OF THIS DOCUMENT

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

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

1   SIGNAL CODES

Signal codes (SC) describe type of passage and the result of the processing of the passage in CPE.

Signal codes defined in an AutoPASS automatic tolling station are (other Signal codes exist but are no longer in use):

Code	Image	MMI (*)	Description	Type of Charge (IP)
02	No	0	Approved passage with OBE	OBE
08	No (**)	0	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	2	Passage with valid OBE in OBU StatusFile where there is mismatch between LPN in OBU StatusFile versus result from ANPR from roadside. SignalCode 21 is only to be used when the ANPR results from the front and rear images match.	ANPR
22	Yes	N/A	Passage without detected OBE or an illegal OBE type (EFC Context Mark (EFC_CM) is not approved).	ANPR
23	Yes	1	Passage with OBE not defined in OBU StatusFile.	ANPR
25	Yes	2	Passage with legal OBE type but authentication failed.	ANPR
26	Yes	2	Passage with legal OBE type but access credential check failed.	ANPR
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 with modus "free of charge".	No charge
42	Yes	N/A	Passage in lane without charging equipment. To be used for passage in opposed lane or bus-bay.	ANPR

Table 1: Overview of Signal Codes

(*) 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 picture is not available

2 SIGNAL CODES-PROCESS DIAGRAM

2.1 Flow chart

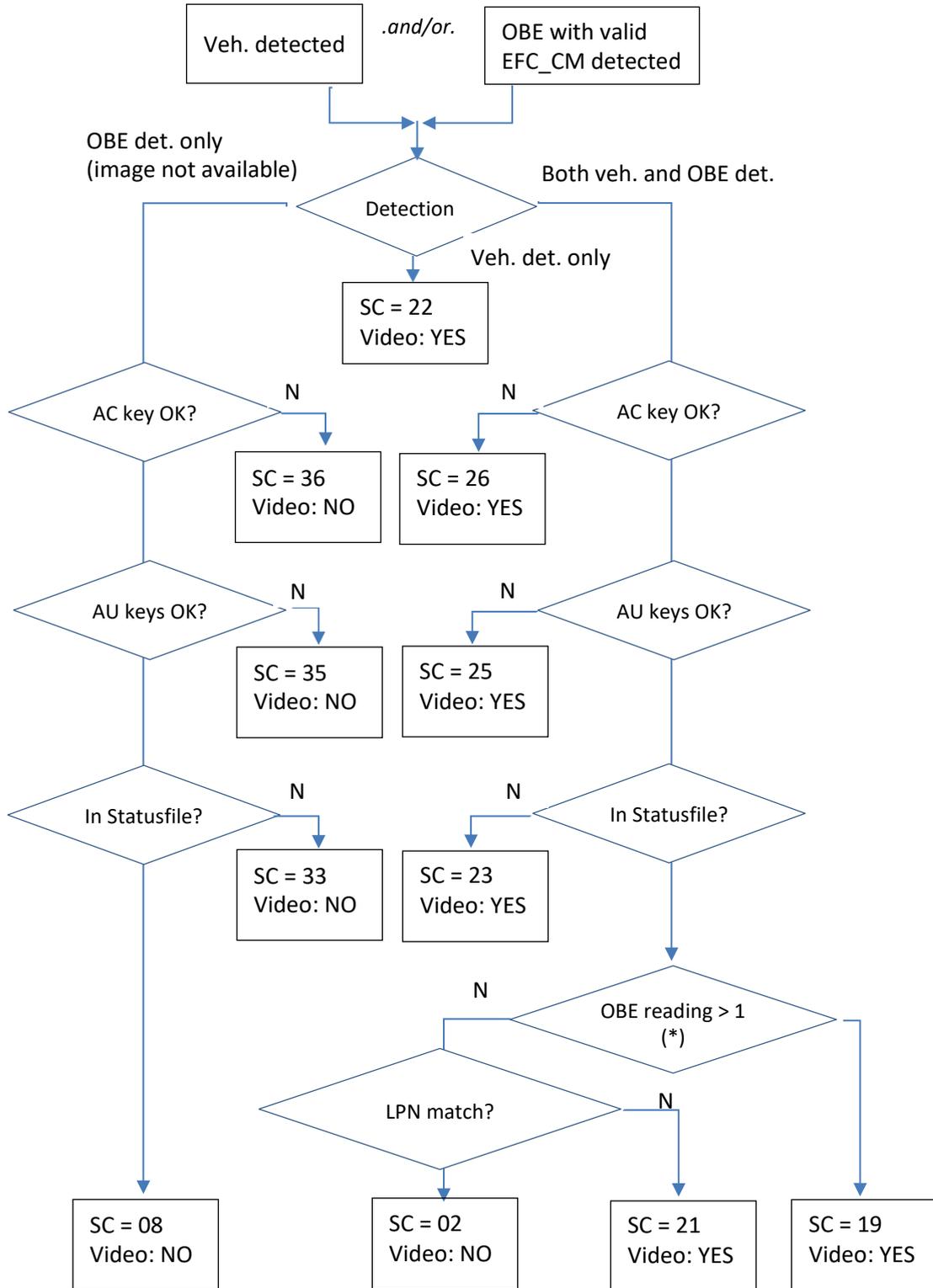*Figure 1: Flow chart of CPE logic*

2.2   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 will be assigned a special signal code SC19. If such OBE readings are not accepted they may be assigned signal codes as eg. SC23. 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 opposed lane or bus-bay. 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.
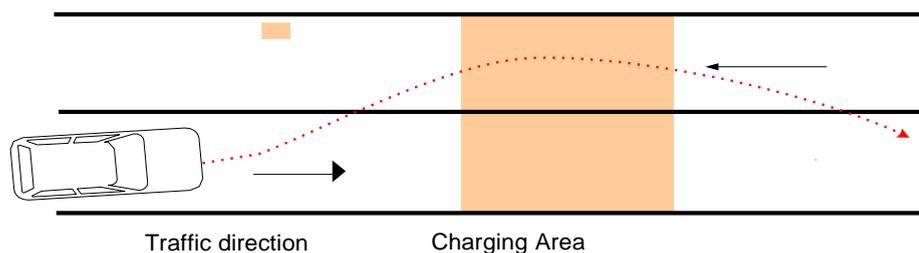
Figure 2: Signal Code 42 case

3 SIGNAL CODES OVERVIEW

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

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 opposed lane or bus-bay.
4.	OK	OK	OBE1: 02,21,23, 25,26 OBE2: 19,21,23, 25,26	As SC02 passage one should select the first processed valid OBE.
5.	Not OK	OK	All OBE: 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.

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