

Request for Proposal

ANPR and MIR service procurement

(procured together or separately)

SSA-L, Appendix 1 Annex 4

AutoPASS Identification Module

Version log

Version	Initials	Date	Comments/ amendments
0.90	GK	11.01.2019	Preliminary RFP sent to Bidder
1.0			
2.0			
3.0			

Customer

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Sign. Customer

Sign. Contractor

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1. INTRODUCTION

This document describes the interface and communication mode between the ANPR solution and MIR module with AutoPASS IP. This interaction is enabled by the AutoPASS Identification module.

1.1 REQUIREMENTS

1.1.1 AutoPASS IP

The following requirements have been defined by the AutoPASS IP project:

- AutoPASS IP shall not process image files received from roadside components. Instead AutoPASS IP shall use the Identification Module to update their vehicle information for a transaction in case the initial confidence level is not satisfactory.
- AutoPASS IP shall refer to the transaction and not to each single image.

The following figure is an extract from the IP detailed design for the identification process:

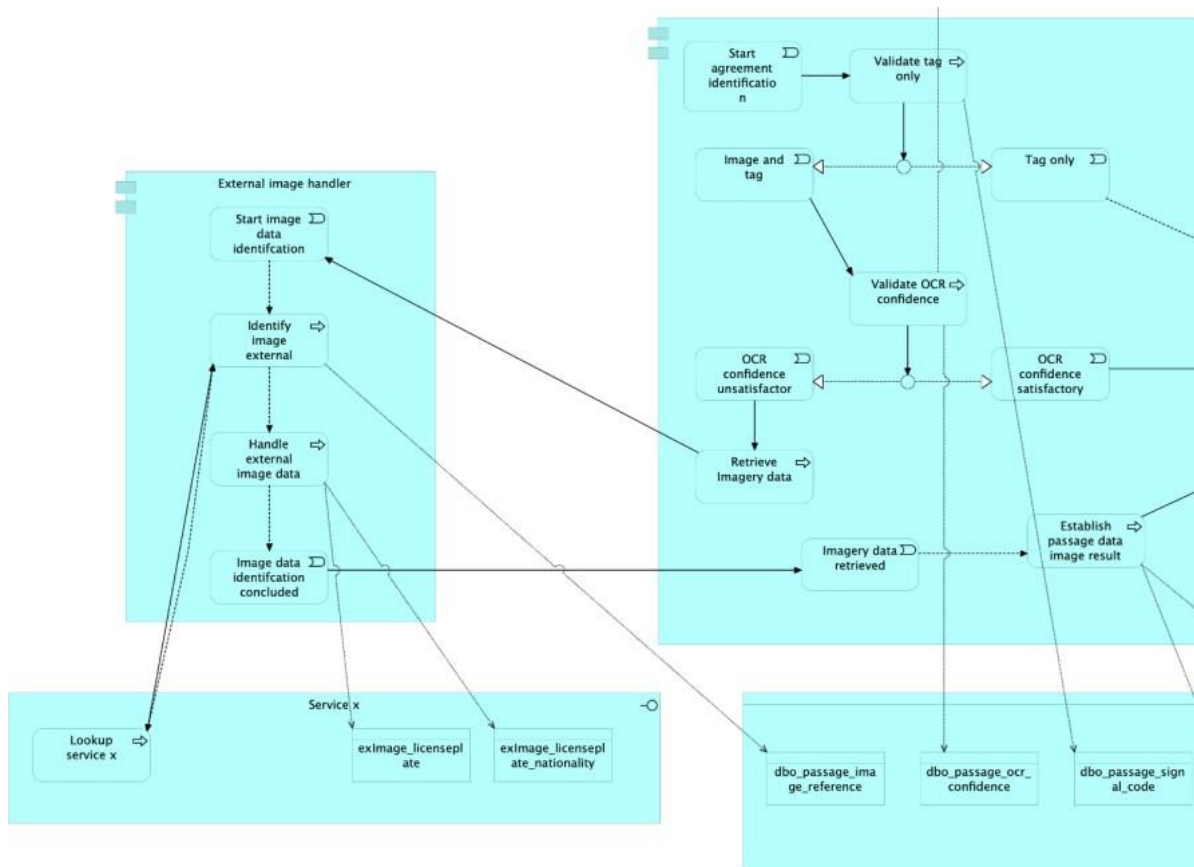


Figure 1: IP detailed design for the identification process

The Identification Module (named "External Image handler" in this diagram) shall be triggered by the IP process "Retrieve Imagery data" and the Identification Module shall issue "Imagery data retrieved" events to IP.

1.1.2 ANPR and MIR

The Identification Module shall send image recognition requests to the ANPR and/or MIR services, based on requests from the AutoPASS IP. The ANPR and MIR services shall handle all images that are related to the same transaction and pass the conclusion to the Image Handler.

The different RBPS' may have different roadside equipment and different views with respect to the image recognition process. – Meaning that the Identification Module will have to deal with different rules for each RBPS.

1.2 IDENTIFICATION MODULE CRITERIA

The Identification Module solution is based on the following criteria:

1. The Identification Module shall use the AutoPASS HUB AMQP message broker to communicate with the other AutoPASS components:
 1. The AutoPASS IP
 2. The ANPR service
 3. The MIR service
2. The Identification Module shall abstract away the ANPR and MIR interfaces for the AutoPASS IP.
3. The Identification Module shall subscribe to image files from the AutoPASS HUB and store those images in the Image Database.
4. The Identification Module shall comply with the AutoPASS principle regarding modularisation.

2. THE IDENTIFICATION MODULE

2.1 OVERVIEW

The Identification Module is connected to:

- The AutoPAS HUB AMQP Broker and the AutoPASS HUB FileStore.
- The AutoPASS OPS Image Database.

The Identification Module solution interacts with other components via the AutoPASS HUB, using AMQP – and consists of the following components:

- The AMQP Image File Consumer. This component subscribes to file references for image files – originating from the Roadsides components.
- The AMQP Transaction Identification Request Consumer. This component subscribes to TransactionIdentificationRequest messages from the AutoPASS IP.
- The AMQP Image Recognition Result Consumer. This component subscribes to ImageRecognitionResult messages from the ANPR and the MIR.

- The AMQP ANPR Request Producer. This component creates ANPRImageRecognitionRequest messages addressed to the ANPR. The AMQP MIR Request Producer. This component creates MIRImageRecognitionRequest messages addressed to the MIR.
- The AMQP Transaction Identification Result Producer. This component creates ImageDataIdentificationResult messages addressed to the AutoPASS IP, based on results received from ANPR and MIR.

The following Archimate model describes the Identification Module application and the interaction with other components.

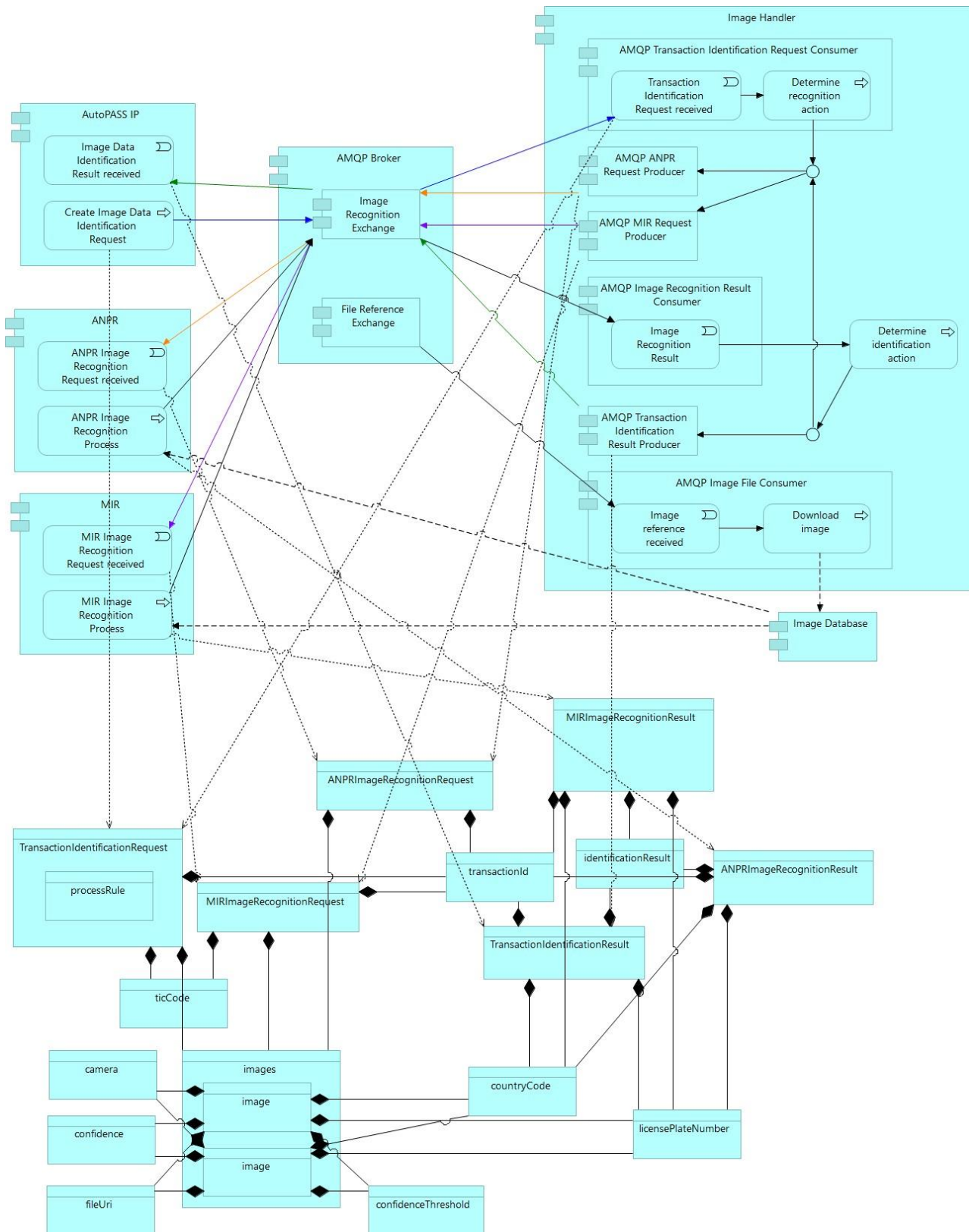


Figure 2: Identification Module archimate model

2.2 IMAGE FILES

2.2.1 AutoPASS HUB subscription

The Identification Module subscribes to all image files (IMG) from the AutoPASS HUB and applies the following actions to each image file:

- Construct the transactionId from the filename (see below).
- Insert the image into the Image Database, including metadata (see below).
- Insert Image reference data into the Image Recognition Database.

2.2.2 The Image Database

The following metadata will be stored for each file object in the [Image Database](#):

- _id (MongoDB specific unique identifier).
- filename. For example "Pic100008_P001_L01_F1_XEX_D2018_10_25_T17_59_23_N00000020.jpg"
- transactionId. See below
- cameraId, based on parameter number 4 (F1 in the example above).
 - 1 = front
 - 2 = back

2.2.3 TransactionId

The transaction ID shall be constructed as a concatenation of the following parameters, based on the picture filename specification in [Design documents#Dataformats](#), Appendix 9, section 1.4:

Table 1: Transaction Id parameters

Parameter	Length (digits)	Sample value	Description
Operator code	6	100008	BIN code
CP	3	001	Charging Point
Lane	2	01	One Charging Point has at least one lane
Year	4	2018	
Mo	2	10	
Day	2	25	
Hour	2	17	
Min	2	59	
Sec	2	23	
SerialNumber	8	00000020	SerialNumber equals SeqV deoPicture in transaction file

The sample transaction Id will then be as follows: "100008001012018102517592300000020". The roadside transaction contains the same parameters and shall be used to construct the exact same transaction Id.

2.3 AMQP MESSAGE DEFINITIONS

Data will be included in the AMQP payload as JSON objects. The following sections provide example JSON objects for each AMQP message type used by the Image Database solution.

The external components need to handle the following AMQP messages:

Table 2: AMQP messages

AMQP message	AutoPASS IP	ANPR	MIR
TransactionIdentificationRequest	Send	N/A	N/A
TransactionDataIdentificationResult	Receive	N/A	N/A
ANPRImageRecognitionRequest	N/A	Receive	N/A
MIRImageRecognitionRequest	N/A	N/A	Receive
ANPRImageRecognitionResult	N/A	Send	N/A
MIRImageRecognitionResult	N/A	N/A	Send

2.3.1 TransactionIdentificationRequest

The AutoPASS IP will send TransactionIdentificationRequest messages to the Identification Module to request recognition of images related to the actual transaction.

Parameters:

Table 3: Transaction identification request parameters

Parameter name	Mandatory	Description	Sample value
transactionId	YES	See TransactionId	"100008001012018102517592300000020"
processRule	YES	1: send to ANPR only 2: send to MIR only 3: send to ANPR, then to MIR if not successful Note: AutoPASS IP shall determine if ANPR and/or MIR shall be requested to recognize the image (s), based on confidence and threshold configurations. This means that AutoPASS IP shall provide the specific processRule (1, 2 or 3).	"2"

images	NO	Array of image parameters, see below. Note: AutoPASS IP shall provide image recognition data if the actual transaction contains such data (that is, the roadside equipment has performed image recognition). AutoPASS IP shall also include the actual confidence threshold that has been defined for the actual place (Operator / Charging point / lane). The image information will be passed to the ANPR such that they can consider the result from the roadside recognition as well during their recognition process.	
ticCode	NO	This parameter can be used to rule the image recognition process. The original parameter is defined Refer to Design documents#Dataformats, Appendix 7, section 1.3.2 as "Reason of rejection EasyGO".	"04"

The image compound parameter is defined as follows:

Table 4: Image compound parameters for transaction identification request

Parameter name	Mandatory	Description	Sample value
camera	YES	1 = front 2 = back	"1"
licensePlateNumber	YES	Identified license plate number	"VF123456"
countryCode	YES	Country code according to ISO 3166-1-Alpha-2	"NO"
confidence	YES	The OCR processes produces confidence levels of the LPN reading, as a measure of the recognition certainty. The measure is given in % as an integer between 0 and 100 Design documents#Dataformats , Appendix 8, section 1.3	"95"
confidenceThreshold	NO	Minimum confidence level for valid recognition - for actual plaza/lane /camera, defined by the actual operator	"90"

TransactionIdentificationRequest sample JSON

```
{
  "transactionId": "1000080010120181025175923000000020",
  "images": [
    {
      "camera": "1",
      "licensePlateNumber": "VF123456",
      "countryCode": "NO",
      "confidence": "95",
      "confidenceThreshold": "90"
    },
    {
      "camera": "2",
      "licensePlateNumber": "VF123456",
      "countryCode": "NO",
      "confidence": "95",
      "confidenceThreshold": "90"
    }
  ],
  "ticCode": "04"
}
```

Figure 3: Transaction identification request sample

2.3.2 TransactionIdentificationResult

The Identification Module will send TransactionIdentificationResult messages to AutoPASS IP (via the AutoPASS HUB) when image data for a transaction has been identified.

Parameters:

Table 5: Transaction identification result parameters

Parameter name	Mandatory	Description	Sample value
transactionId	YES	See TransactionId	"1000080010120181025175923000000020"
identificationResult	YES	0 = failed to identify 1 = successful identification	"1"
licensePlateNumber	NO	Identified license plate number	"VF123456"
countryCode	NO	Country code according to ISO 3166-1-Alpha-2	"NO"

Sample JSON:

TransactionIdentificationResult sample JSON

```
{"transactionId":"100008001012018102517592300000020",
"identificationResult":"1",
"licensePlateNumber":"VF123456",
"countryCode":"NO"}
```

Figure 4: Transaction identification result sample

2.3.3 ANPRImageRecognitionRequest

The Identification Module will send ANPRImageRecognitionRequest messages to the ANPR (via the AutoPASS HUB) when a transaction needs automatic image recognition.

Parameters:

Table 6: ANPR image recognition request parameters

Parameter name	Mandatory	Description	Sample value
transactionId	YES	See TransactionId	"100008001012018102517592300000020"
images	YES	Array of image parameters, see below	Array of image parameters, see below

The image compound parameter is defined as follows:

Table 7: Image compound parameters for ANPR image recognition request

Parameter name	Mandatory	Description	Sample value
camera	YES	1 = front 2 = back	"1"
licensePlateNumber	YES	Identified license plate number	"VF123456"
countryCode	YES	Country code according to ISO 3166-1-Alpha-2	"NO"
confidence	YES	The OCR processes produces confidence levels of the LPN reading, as a measure of the recognition certainty. The measure is given in % as an integer between 0 and 100 Refer to Design documents#Dataformats , Appendix 8, section 1.3	"95"
confidenceThreshold	NO	Minimum confidence level for actual plaza/lane/camera, defined by the actual operator	"90"
fileUri	YES	The file URI for downloading of image.Mandatory for ANPR and MIR	See sample JSON

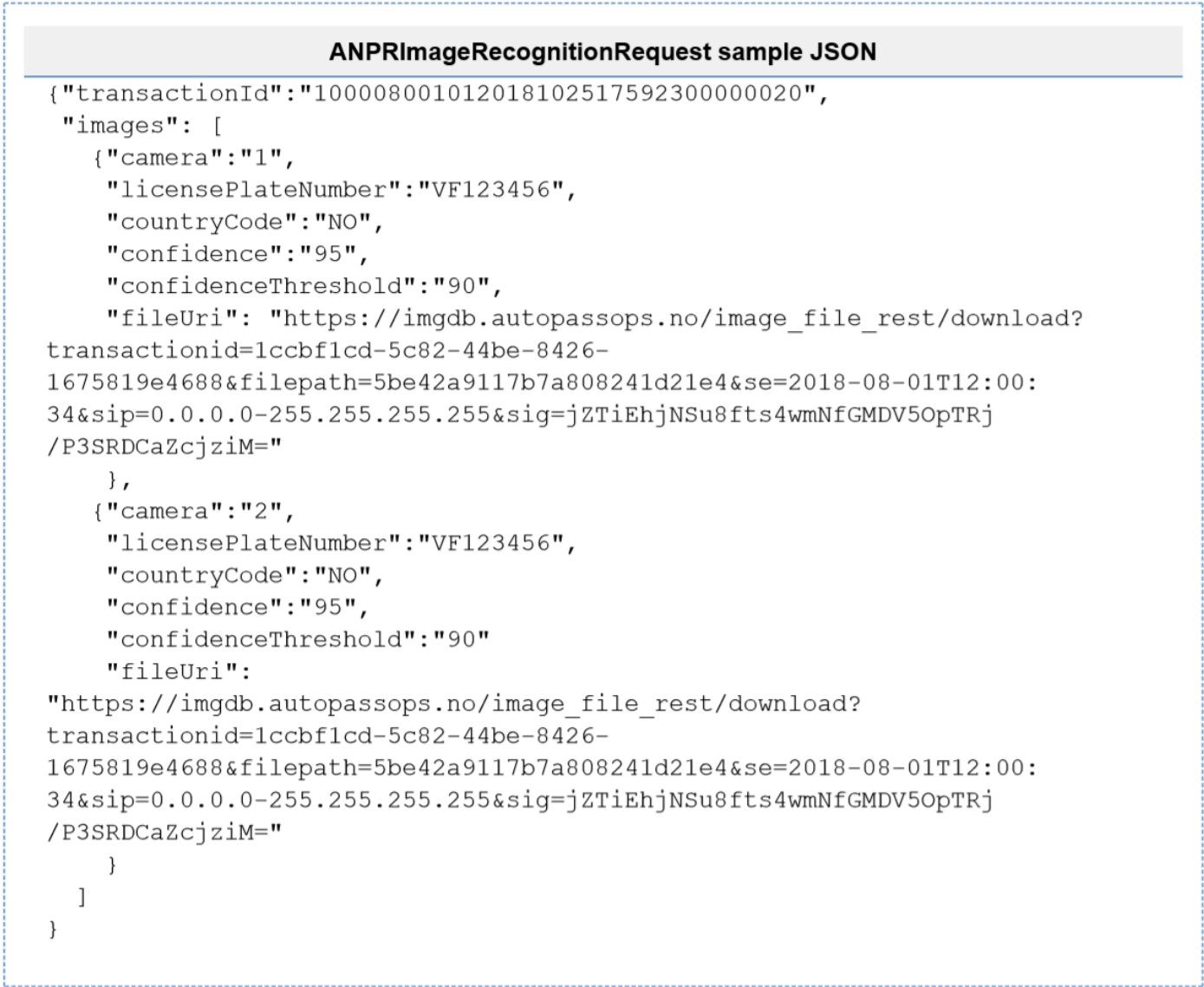


Figure 5: ANPR image recognition request sample

2.3.4 MIRImageRecognitionRequest

The Identification Module will send MIRImageRecognitionRequest messages to the MIR (via the AutoPASS HUB) when a transaction needs manual image recognition.

Parameters:

Table 8: MIR image recognition request parameters

Parameter name	Mandatory	Description	Sample value
----------------	-----------	-------------	--------------

transactionId	YES	See TransactionId	"100008001012018102517592300000020"
ticCode	NO	See TransactionIdentificationRequest	"04"
images	YES	Array of image parameters, see below	Array of image parameters, see below

The image compound parameter is the same as for the [ANPRImageRecognitionRequest](#).

2.3.5 ANPRImageRecognitionResult

The ANPR sends ANPRImageRecognitionResult messages to the Identification Module (via the AutoPASS HUB).

Parameters:

Table 9: ANPR image recognition result parameters

Parameter name	Mandatory	Description	Sample value
transactionId	YES	See TransactionId	"100008001012018102517592300000020"
identificationResult	YES	0 = failed to identify 1 = successful identification Note: A value "0" indicates that the transaction is not chargeable	"1"
licensePlateNumber	NO	Identified license plate number.	"VF123456"
countryCode	NO	Country code according to ISO 3166-1-Alpha-2	"NO"

ANPRImageRecognitionResult sample JSON

```
{
  "transactionId": "100008001012018102517592300000020",
  "identificationResult": "1",
  "licensePlateNumber": "VF123456",
  "countryCode": "NO"
}
```

Figure 6: ANPR image recognition result sample

2.3.6 MIRImageRecognitionResult

The MIR sends MIRImageRecognitionResult messages to the Identification Module (via the AutoPASS HUB). The format of the MIRImageRecognitionResult is equal to the ANPRImageRecognitionResult.