| Change Request Form | |
| --- | --- |
| Logo, company name  Description automatically generated | CR Software Functions  – Proposed Changes |
| Document Summary | |
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| Change Request Security Classification | Non-confidential |
| Is this a new document or a Major or Minor Change? | New Document |
| Will this Change Request result in a Major or Minor version update? | Major Version |
| This document is for | Discussion |
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| What are the reasons for and benefits of creating this new document or Change Request? | Propose changes for software functions. |

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# Software Functions

## On-device model update

### Test purpose

To verify that the DUT can support on-device model update.

### Referenced Requirements

|  |  |
| --- | --- |
| TS47\_3.2\_REQ\_001 | An AI Mobile Device SHALL support on-device model updates of an existing deep learning network. |

### Preconditions

* **Updated Model preparation**

1. Check the AI models that the DUT already supports (Self-declaration FORM)
2. Pick one of the models and modify its weights to create the Updated Model.

* **Dataset preparation**

Prepare a dataset that matches the selected model for inferencing usage. Note that, the selected dataset should be identical for before and after the update in order to compare the results to make sure the model has changed properly.

### Initial configuration

DUT is Switched OFF.

### Test procedure

| Step | Test procedure | Expected result |
| --- | --- | --- |
| 1 | Switch DUT on. | DUT is in idle mode. |
| 2 | Save the result from current model and selected dataset. | The model is successfully run and give the result |
| 3 | Load the updated model on DUT. | The updated model is successfully loaded with no exception. |
| 4 | Process the same dataset using the updated model. | The updated model can be run on the device successfully and can be used for inferencing. |
| 5 | Compare the results before and after update | The results should be different. |

## Native API requirements

### Test purpose

To verify that the DUT has native APIs to expose AI hardware functions.

### Referenced Requirements

|  |  |
| --- | --- |
| TS47\_3.2\_REQ\_002 | An AI Mobile Device SHALL support native APIs to expose the AI hardware functions. |

### Preconditions

* **Check what native APIs are supported**

Look into the Self declare Form to see what native APIs are supported in the DUT and what AI hardware functions are exposed. (Self-declaration FORM)

* **Native APIs Test Scripts preparation**

According to the supported APIs, GCF or third party should download ML-Commons benchmark app to test whether the native APIs can be called successfully and function normally.

### Initial configuration

DUT is Switched OFF.

DUT is loaded with native API test scripts which is provided by ML-commons [7].

### Test procedure

| Step | Test procedure | Expected result |
| --- | --- | --- |
| 1 | Switch DUT on. | DUT is in idle mode. |
| 2 | Run the native API test scripts on DUT. | The Native APIs are called successfully and function normally. |

## Application APIs requirements

### Test purpose

To verify that DUT provides application APIs for commonly used AI models: Computer Vision (CV), Automatic Speech Recognition (ASR), Natural Language Understanding (NLU) models.

### Referenced Requirements

|  |  |
| --- | --- |
| TS47\_3.2\_REQ\_003 | An AI Mobile Device SHALL support application APIs (See Appendix A) for native and third-party applications to access Computer Vision (CV), Automatic Speech Recognition (ASR), Natural Language Understanding (NLU) models. |

### Preconditions

* **Check whether the required application APIs are supported**

Look into the Self declare Form to see whether the required application APIs are supported in the DUT for some commonly used AI models. (Self-declaration FORM)

* **Application APIs Test Script preparation**

Use ML-Commons inferencing scenario for commonly used AI model such as Computer Vision (CV), Automatic Speech Recognition (ASR), Natural Language Understanding (NLU) to test whether the required application APIs can be called successfully and function normally.

### Initial configuration

DUT is Switched OFF.

DUT is loaded with application API test script provided by ML-Commons [7].

### Test procedure

| Step | Test procedure | Expected result |
| --- | --- | --- |
| 1 | Switch DUT on. | DUT is in idle mode. |
| 2 | Run application API test script for the validation that DUT has the API to access CV model. | The related API(s) is invoked successfully and the expected output is obtained from the model.  Note: After the model is determined, expected output should be specified. |
| 3 | Run application API test script for the validation that DUT has the API to access ASR model. | The related API(s) is invoked successfully and the expected output is obtained from the model.  Note: After the model is determined, expected output should be specified. |
| 4 | Run application API test script for the validation that DUT has the API to access NLU model. | The related API(s) is invoked successfully and the expected output is obtained from the model..  Note: After the model is determined, expected output should be specified. |

## Model Format conversion

### Test purpose

To verify that DUT has the SDK to convert model format to its native format so that the model can be run successfully on the DUT.

### Referenced Requirements

|  |  |
| --- | --- |
| TS47\_3.2\_REQ\_004 | An AI Mobile Device SHOULD provide an SDK to convert DNN models from an existing format to the native format of the AI mobile device. Non-exhaustive examples of DNN model file format are: \*.ckpt or \*.pb, \*.tflite, \*.prototxt, \*.pb or \*.pth or \*.pt, \*.json and \*.onnx. |

### Preconditions

* **Check what are the formats that can be converted to native format by the SDK**

Look into the Self declare Form to see what formats can be converted by the SDK to the native one (Self-declaration FORM)

* **Test Models with the supported formats preparation**

Prepare models with the supported formats for testing.

### Initial configuration

DUT is Switched OFF.

### Test procedure

| Step | Test procedure | Expected result |
| --- | --- | --- |
| 1 | Run the SDK to convert the format of test model to native format. | Test model is successfully converted into a DUT supported format. |
| 2 | Switch DUT on. | DUT is in idle mode. |
| 3 | Load the converted model on DUT. | The converted model is successfully loaded with no exception. |

## Customized Operator

### Test purpose

To verify that DUT support new operator customization.

### Referenced Requirements

|  |  |
| --- | --- |
| TS47\_3.2\_REQ\_005 | An AI Mobile Device SHOULD provide an SDK to support definition of new customized Deep Learning operators. |

### Preconditions

* **Check what operators are supported by DUT**

Look into the Self declare Form to see what operators are supported and what is not. (Self-declare FORM)

* **Operator Customization**

Using the supplied SDK, customize a new operator.

* **Create a model as test model with the new defined operator**

Create a model that utilizes the new operator.

### Initial configuration

DUT is Switched OFF.

Covert the test model to native format of DUT if necessary.

### Test procedure

| Step | Test procedure | Expected result |
| --- | --- | --- |
| 1 | Switch DUT on. | DUT is in idle mode. |
| 2 | Load the test model on DUT. | The test model is successfully loaded with no exception, and the expected output is obtained.  Note: After the model is determined, expected output should be specified. |

## 1.5 References

Requirements shall be based on the exact versions as indicated below. However if the manufacturers use a later release and/or version this should be indicated. The GSMA will continually align with other SDOs as appropriate.

| Ref | Doc Number | Title |
| --- | --- | --- |
|  | GSMA PRD TS.47 | AI Mobile Device Specification, Version 1.0, September 2019 |
| [2] | ISO-IEC-19795-1 | Information technology — Biometric performance testing and reporting —Part 1: Principles and framework |
| [3] |  | FIDO Biometrics Requirements (2020) |
| [4] | GSMA PRD TS.29 | Smartphone Performance Test Case Guideline Version 6.0 or later |
| [5] | RFC 2119 | “Key words for use in RFCs to Indicate Requirement Levels”, S. Bradner, March 1997. Available at <http://www.ietf.org/rfc/rfc2119.txt> |
| [6] | RFC8174 | Ambiguity of Uppercase vs Lowercase in RFC 2119 Key Words  <https://www.rfc-editor.org/info/rfc8174> |
| [7] |  | <https://github.com/mlcommons> |
| [8] |  | MLPerf Inference Benchmark, https://arxiv.org/abs/1911.02549 |