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Abstract

This document reviews existing certification schemes (both regulatory and private certifications) for LTE and Wi-Fi devices and applications and proposes a suitable certification scheme for pre 5G devices and applications according to the testing defined in this project.

Keywords

certification scheme, LTE, 5G, Wi-Fi

Document history

V1.0	Initial release of the document
V2.0	General rewriting of the document based on the feedback received by the expert panel at the project final review. Changes are:
	Creation of the document based on the latest Test Specifications (including what was created after the publication of the V1.0)
	New set of Annexes

Executive summary

The main objective of this document is to provide the final TRIANGLE Test Specifications and Test Scenario.

The body of the document contains all Test Specifications grouped in a single document. Section 2 of the document defines the Test Conditions applicable to all test cases, being the System Under Test (SUT) and App, a mobile device or an IoT device. Section 3 indicates the way to handle the SUT to perform appropriately the test cases.

Sections 4, 5 and 6 are the heart of the document, containing all the test cases specified in TRIANGLE. Section 4 covers application test cases, while Section 5 contains mobile devices test cases and Section 6, IoT devices test cases.

Section 7 provides the applicability of all test cases included in this document according to the SUT ICS declaration (section 9).

Section 8 provides the translation for obtaining the Key Performance Indicators (KPIs) required for calculating TRIANGLE mark, from the measurements used in the test cases.

Section 9 and 10 contain the ICS and IXIT respectively defined in the project that characterize the features of the apps and devices.

Annex A shows a general view of main TRIANGLE concepts used in this document, that compose the testing framework, detailing TRIANGLE domains, use cases, scenarios, test cases, etc.

Annex B is devoted to the definition of the network parameters used to emulate the scenarios to be used in the test cases.

Annex C identifies the applications that are executed on mobile devices to test these devices performance.

Finally, Annex D details the TRIANGLE certification scheme (as it was specified in D2.2), with Annex E providing a Certification Application Form that an applicant may use to request the start of a certification process.

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1 Introduction

1.1 Purpose

This Test Specification contains the test cases defined by TRIANGLE project to evaluate and verify the performance of mobile applications, mobile devices and IoT devices.

1.2 Scope of testing

This Test Specification is applicable to mobile applications, mobile devices and IoT devices.

The test cases included in this test specification are designed to obtain Key Performance Indicators (KPIs) to determine mobile applications, mobile devices and IoT devices performance required to obtain the TRIANGLE mark.

The test cases in this Test Specification are initially defined to be implemented in TRIANGLE testbed.

1.3 Definitions and Acronyms

Table 1 – Definitions

State	Description
Application User Flow	The sequence of actions which the user's AUT is expected to perform on the AUT user interface objects in order to execute a test step of this test specification.
AUT Backend Service	Remote endpoint of the AUT service layer
Dummy Battery Fixture	Device designed to replace the usual Host Device battery to facilitate powering the Host device from an external DC source and simulating normal behaviour of the replaced battery
Host Device	Android or iOS device where the AUT is installed in order to test the AUT
Network Scenario	Usage scenario which is defined by a parameterization of the air interface and the core network
Network Scenario	Usage scenario as described in Deliverable D2.2 [1] which is defined by a parameterization of the air interface and the core network
Reference App Backend Service	Remote endpoint of the Reference App service layer
Reference App	Android or iOS App installed in the DUT to measure the DUT performance according to TRIANGLE requirements.
Reference App API	API that lets embedding a reference app implementation on the DUT (e.g., File download in this specification).
Reference App API action	Action to be performed by a reference API that can be invoked through its API
Test System	Integrated system used to measure the AUT's performance against this test specification.
TRIANGLE Testbed	TRIANGLE testing framework. It covers all the software, and the coordination/sequencing that control & connects to the test infrastructure. It is in charge of handling and transforming the end user test requests into actionable steps for the software and hardware components of the testbed.

Table 2 – Acronyms

State	Description
AR	Augmented Reality
ARRA	Augmented Reality Reference App
AUT	Application Under Test
CPU	Central Processing Unit
CS	Content Distribution Streaming Services
CSRA	Content distribution Streaming Services Reference App
CV	Connected Vehicles
DUT	Device Under Test
EM	Emergency Services
EMRA	Emergency Services Reference App
GA	Gaming
GARA	Gaming Reference App
GPU	Graphics Processing Unit
HS	High Speed Internet
HSRA	High Speed Internet Reference App
ICS	Implementation Conformance Statement
IXIT	Implementation eXtra Information for Testing
ksps	KiloSamples per second (thousands of samples per second)
LS	Live Streaming services
LSRA	Live Streaming Services Reference App
PM	Patient Monitoring
PMRA	Patient Monitoring Reference App
SG	Smart Grids
SM	Smart Metering
SN	Social Networking
SUT	System Under Test
VR	Virtual Reality
VRRA	Virtual Reality Reference App

2 General Test conditions

Unless otherwise specified in a particular test case, the conditions defined in this section will apply for all test cases.

2.1 Test System configuration

2.1.1 Applications

The figure below shows a simplified overview of the testing architecture for testing applications.
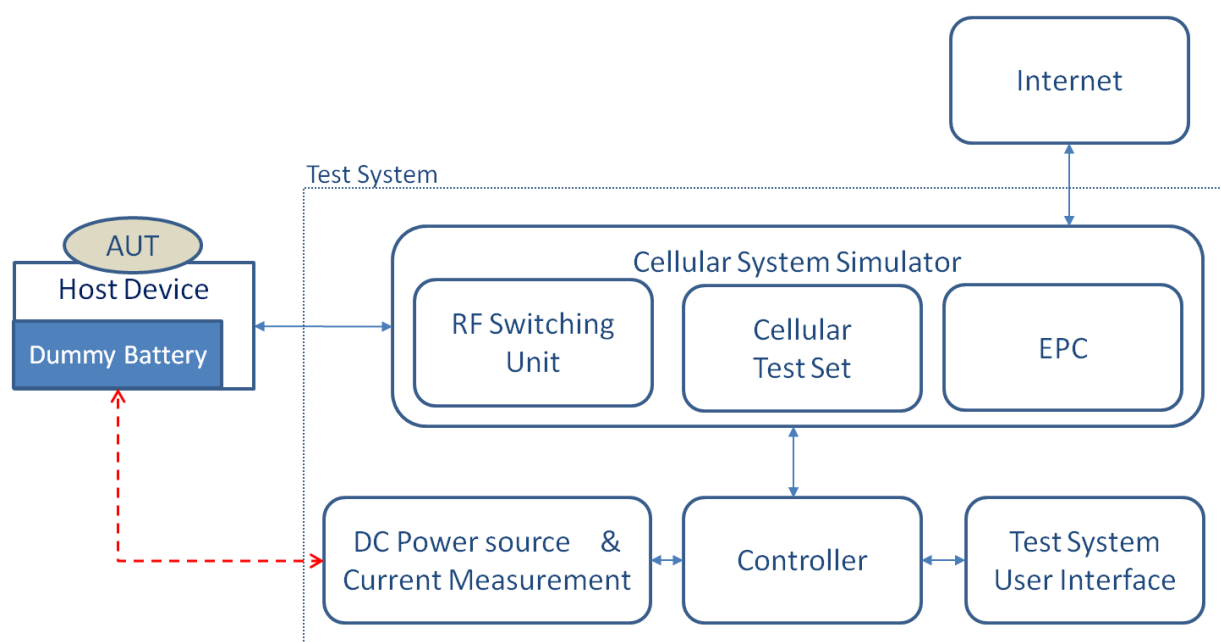
Figure 1 – Test System architecture overview for testing Apps

The App under test (AUT) is installed in the Host Device. The Host Device is connected to the Test System though a conducted RF connection.

The Host Device is grid powered if feasible. If the Host Device is battery powered, the battery of the Host Device is fully charged.

The Test System is configured to perform the test cases will be one of the bands supported by the Host Device. In case any of the bands listed next is supported by the device it will be selected and in the order defined: 1. FDD4; 2.FDD17; 3. FDD14; 4. FDD25; 5. FDD2; 6. FDD5; 7. FDD7; 8. FDD12; 9. FDD12; 10. FDD30.

The Test System network is initially configured as specified by the latest release of 3GPP TS 36.508.

The Test System shall provide a way to rotate the Host Device according to the 3 space axis, as required by certain VR and AR use cases test cases.

In the case of energy consumption domain, additionally following configuration applies:

The DC Power Source and Current Measurement device provides DC power source to the Host Device and measures the Host Device current consumption.

The DC Power Source will have the following functionalities:

- Configurable output voltage.

- Output Resolution at least 0.01 volt.

- Output voltage range including the nominal voltage of the Host device (+- 5%)

- Remote sensing recommended; for the maintenance of the nominal voltage of the Host Device.

- Enough continuous and peak output current capability to cover Host Device requirements during the measurements.

The Current measurement device will have the following functionalities:

- Measurement resolution: At least 0.1 mA.

- Sampling frequency: No less than 50 ksps

The Test System is configured to perform the test cases will be one of the bands supported by

2.1.1.1 Host Device configuration

The Host Device will be configured as defined below:

- The Host Device is ON and there are no Apps running other than required system apps.

- No antivirus and/or anti-malware App is running.

- Maximum brightness available.

- Maximum screen resolution available.

- No Energy saving or screen saving option is enabled.

- Vibration is enabled if available.

- The Host Device is allowed to use mobile data.

- There is no restriction configuration for data use.

- The Host Device Audio Volume is configured at the middle of the available range.

- The Host Device has been ON for at least three minutes to allow all boot processes to be completed.

- The Host Device screen is configured with screen always ON.

In the case of energy consumption domain, additionally following configuration applies:

- The Host Device battery is replaced by a dummy battery fixture.

- The dummy battery shall provide a connection between the Host Device battery terminals and the DC power source.

- The dummy battery will provide means to minimize, as far as possible, the resistance, inductance and length of cables required to connect the fixture to the DC power supply.

- The dummy battery may provide source and sense conductors to keep the nominal battery voltage as stable as possible.

2.1.2 Mobile Devices

The figure below shows a simplified overview of the testing architecture.
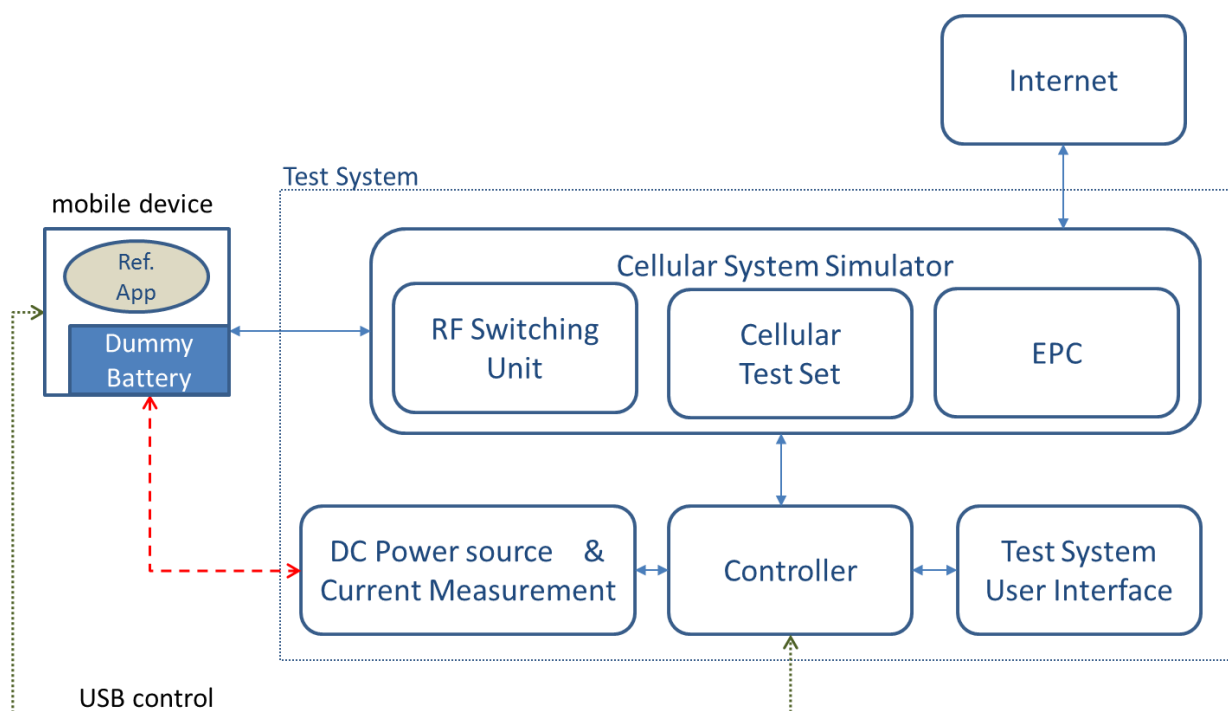
Figure 2 – Test System architecture overview for testing mobile devices

The Device Under Test (DUT) is connected to the Test System though a conducted RF connection as shown in the figure above.

The 'DC Power Source and Power Measurement' device provides DC power source to the DUT and measures the DUT power consumption.

The DC Power Source to be used in Energy Consumption test cases will have the following functionalities:

- Configurable output voltage.

- Output Resolution at least 0.01 volt.

- Output voltage range including the nominal voltage of the DUT (+- 5%)

- Remote sensing recommended; for the maintenance of the nominal voltage of the DUT.

- Enough continuous and peak output current capability to cover the DUT requirements during the measurements.

The Power measurement device will have the following functionalities:

- Measurement resolution: At least 0.1 mA.

- Sampling frequency: No less than 50 ksps

- At least, two independent measurement inputs.

The DUT battery is replaced by a dummy battery fixture.

The dummy battery shall provide a connection between the DUT battery terminals and the DC power source.

The dummy battery will provide means to minimize, as far as possible, the resistance, inductance and length of cables required to connect the fixture to the DC power supply.

The dummy battery may provide source and sense conductors to keep the nominal battery voltage as stable as possible.

The DUT is connected to its power source according to the normal operation conditions defined by the DUT's provider.

The Reference Apps applicable for each use case, as defined in Annex C are used to perform the required operations while performing the test cases measurements.

It is recommended to use Reference Apps APIs to ease the test case automation.

The Reference App Backend Service applicable for each use case is accessible from the Test System.

The Test System is configured to perform the test cases will be one of the bands supported by the device. In case any of the bands listed next is supported by the DUT it will be selected and in the order defined: 1. FDD4; 2.FDD17; 3. FDD14; 4. FDD25; 5. FDD2; 6. FDD5; 7. FDD7; 8. FDD12; 9. FDD12; 10. FDD30.

The Test System network is initially configured as specified by the latest release of 3GPP TS 36.508.

The content of the test packets used by the Test System for throughput measurements is random.

Note: It is recommended that the DUT uses always the same frequency band, as it may affect the results obtained.

The Test System network is initially configured as specified by the latest release of 3GPP TS 36.508.

The test environment lightning is set to office conditions with no direct sun light on the DUT.

2.1.2.1 DUT configuration

The DUT will be configured as defined below:

- The DUT is ON

- The only Apps running on the DUT are the apps provided by the manufacturer when the product is obtained commercially (factory configuration) that are started when the mobile device is switched on.

- There is no restriction configuration for data use.

- No antivirus and/or anti-malware App is running.

- Maximum brightness available.

- Maximum screen resolution available.

- No Energy saving or screen saving option is enabled.

- Vibration if available is disabled.

- The DUT is configured to allow the use of mobile data.

- The DUT Audio Volume is configured at the middle of the available range.

- The DUT screen is configured with screen always ON.

- The DUT has been on for at least three minutes to allow all boot processes to be completed.

2.1.3 IoT Devices

The figure below shows a simplified overview of the testing architecture.
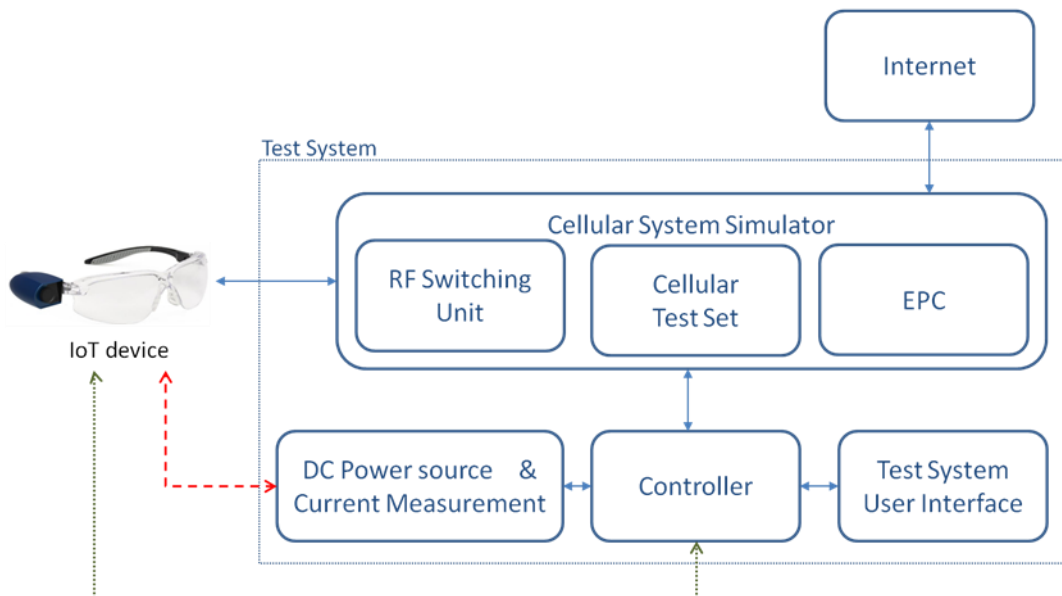
Figure 3 – Test System architecture overview for testing IoT devices

The IoT device is connected to the Test System though a conducted RF connection.

The DC Power Source and Current Measurement device provides DC power source to the IoT Device and measures the IoT Device current consumption.

The DC Power Source will have the following functionalities:

- Configurable output voltage.

- Output Resolution at least 0.01 volt.

- Output voltage range including the nominal voltage of the Host device (+- 5%)

- Remote sensing recommended; for the maintenance of the nominal voltage of the IUT.

- Enough continuous and peak output current capability to cover IUT requirements during the measurements.

The Current measurement device will have the following functionalities:

- Measurement resolution: At least 0.1 mA.

- Sampling frequency: No less than 50 ksps

In the case of battery operated IoT devices, the battery will be replaced by a dummy battery fixture.

The dummy battery shall provide a connection between the IoT Device battery terminals and the DC power source.

The dummy battery will provide means to minimize, as far as possible, the resistance, inductance and length of cables required to connect the fixture to the DC power supply.

The dummy battery may provide source and sense conductors to keep the nominal battery voltage as stable as possible.

In the case of grid operated IoT devices, the IoT device will be connected to the DC power source by the appropriate connector, trying to minimize the resistance, inductance and length of cables required.

The Test System is configured to perform the test cases will be one of the bands supported by the IoT Device. In case any of the bands listed next is supported by the device it will be selected and in the order defined: 1. FDD4; 2.FDD17; 3. FDD14; 4. FDD25; 5. FDD2; 6. FDD5; 7. FDD7; 8. FDD12; 9. FDD12; 10. FDD30.

Note: It is recommended that the IoT Devices always use the same frequency band, as it may affect the results obtained.

The Test System network is initially configured as specified by the latest release of 3GPP TS 36.508.

2.1.3.1 IoT device configuration

The IoT device will be configured according to the standard configuration provided by the supplier in the IoT device user manual.

- If the IoT device has an screen, it will be configured as follows:
    - Maximum brightness available
    - Maximum screen resolution available.
    - No Energy saving or screen saving option is enabled.

- The IoT device is allowed to use mobile data.

- There is no restriction configuration for data use.

- If the IoT device supports audio Volume, it is configured at the middle of the available range.

- The IoT device is ON for at least two minutes to allow all boot processes to be completed.

2.2 Network Scenarios Applicability

The test cases will be executed for each of the Network Scenarios applicable for each Use Case as shown in Table 3 (for Apps and Mobile devices) and in Table 5 (for IoT devices).

Table 4 shows the additional case of mobile devices radio performance.

Table 3 – Mobile devices and Apps Use Case / Network Scenarios Applicability

Network Scenario	Use Cases								
	CS	**LS**	**SN**	**HS**	**VR**	**AR**	**PM**	**ES**	**GA**
Urban-Office	Y		Y	Y	Y	Y		Y	Y
Urban-Pedestrian	Y	Y	Y	Y		Y			Y
Urban-Driving-Normal	Y	Y	Y	Y		Y	Y		Y
Urban-Driving-Traffic jam	Y		Y	Y		Y	Y		Y
Urban-Driving-Emergency driving		Y	Y	Y		Y	Y	Y	
Urban-Internet Café, Busy Hours	Y		Y	Y	Y	Y			Y
Urban-Internet Cafe, Off-Peak	Y		Y	Y	Y	Y			Y
Suburban-Festival	Y	Y	Y	Y		Y		Y	Y
Suburban-Stadium	Y	Y	Y	Y		Y		Y	Y
Suburban-Shopping Mall, Busy Hours	Y		Y	Y		Y		Y	Y
Suburban-Shopping Mall, Off-Peak	Y		Y	Y		Y		Y	Y
High Speed-Relay	Y		Y	Y					Y
High Speed-Direct Passenger Connection	Y		Y	Y					Y

Table 4 – Network scenarios for Radio Performance test cases

Network Scenario	Use Case (HS)
Very low coverage	RFP/HS/001
Adjacent Interferer	RFP/HS/002

Table 5 – IoT Devices Use Case / Network Scenarios Applicability

	Network Scenario	Use Cases				
SC	Network Scenario	PM	ES	SM	SG	CV
UR-OF	Urban-Office		Y	Y		
UR-PE	Urban-Pedestrian					
UR-DN	Urban-Driving-Normal	Y				Y
UR-DT	Urban-Driving-Traffic jam	Y				Y
UR-DE	Urban-Driving-Emergency driving	Y	Y			Y
UR-IB	Urban-Internet Café, Busy Hours					
UR-IO	Urban-Internet Cafe, Off-Peak					
SU-FE	Suburban-Festival		Y			
SU-ST	Suburban-Stadium		Y			
SU-SB	Suburban-Shopping Mall, Busy Hours		Y			
SU-SO	Suburban-Shopping Mall, Off-Peak		Y			
HS-RE	High Speed-Relay					Y
HS-DP	High Speed-Direct Passenger Connection					Y
IT-WA	Internet of Things-Warehouse			Y		
IT-OS	Internet of Things-Outdoor Sensors			Y	Y	
IT-HS	Internet of Things-Home Sensors	Y		Y	Y	

2.3 Number of Test Iterations

In order to obtain statistically relevant measurements out of which the KPIs will be derived (section 8), the test cases will be iterated 100 times, except for the following tests that will be iterated as shown in Table 4.

Table 6 – Test case Iterations

Test Case	# of Iterations
-	-

2.4   Test Case Initial Conditions

2.4.1   Applications

Following initial conditions modes are defined:

AUT-NOT RUNNING

- The AUT is installed on the Host Device.

- The Host Device is configured as specified in section 2.1.1.1.

- The Test System and the Host Device are connected as shown in Figure 1.

- The AUT Backend Service is accessible from the Test System.

- Test Environment Lightning: Office conditions with no direct sun light on the Host Device.

- The Test System is configured according to the target Network Scenario as defined in Annex B (Network scenarios parameterisation).

- The Test System has established a data path with the Host Device.

AUT-STARTED

- The AUT is installed on the Host Device.

- The Host Device is configured as specified in section 2.1.1.1.

- The Test System and the Host Device are connected as shown in Figure 1

- The AUT Backend Service is accessible from the Test System.

- Test Environment Lightning: Office conditions with no direct sun light on the Host Device.

- The Test System is configured according to the target Network Scenario as defined in Annex B (Network scenarios parameterisation).

- The Test System has established a data path with the Host Device.

- The Test System has cleared the AUT stored data and cache.

- The Test System has opened the AUT.

2.4.2   Mobile devices

Following initial conditions modes are defined:

DUT-ON

- The DUT is configured as specified in section 2.1.2.1.

- No reference Apps are installed on the DUT.

- The Test System and the DUT are connected as shown in section 2.1.2.

- There is no restriction configuration for data use.

- Test Environment Lightning: Office conditions with no direct sun light on the DUT.

- The Test System has cleared any Reference App stored data and cache.

- The Test System has established a data path with the DUT.

DUT-READY

- The DUT is configured as specified in section 2.1.2.1.

- The Reference App (according to the use case to be tested) is installed on the DUT. For common services case (section 3.1) a SNRA is used is used.

  Note: Reference Applications are identified in [1].

- The Reference App Backend Service is accessible from the Test System.

- The Test System and the DUT are connected as shown in section 2.1.2.

- The Test System has established a data path with the DUT.

- There is no restriction configuration for data use.

- The Test System is configured according to the target Network Scenario (refer to section 2.2).

- Test Environment Lightning: Office conditions with no direct sun light on the DUT.

- The Test System has cleared any Reference App stored data and cache.

2.4.3 IoT devices

Following initial conditions modes are defined:

IUT-OFF

- The IUT is OFF.

- The IUT is configured as specified in section 2.1.3.1.

- The Test System and the IUT are connected as shown in figure 1.

- The IUT Backend Service (if existing and required) is accessible from the Test System.

- Test Environment Lightning: Office conditions with no direct sun light on the IUT.

- The Test System is configured according to the target Network Scenario as defined in Annex B (Network scenarios parameterisation).

IUT-STARTED

- The IUT is ON.

- The IUT is configured as specified in section 2.1.3.1.

- The Test System and the IUT are connected as shown in figure 1.

- The IUT Backend Service (if existing and required) is accessible from the Test System.

- Test Environment Lightning: Office conditions with no direct sun light on the IUT.

- The Test System is configured according to the target Network Scenario as defined in Annex B (Network scenarios parameterisation).

- The Test System has established a data path with the IUT.

2.5 Test Case Postamble

Unless stated otherwise in the test case description, the following steps will be executed after the test case steps:

- The System closes the Application (Reference App or AUT).

- The Test System shuts down the data path with the device (Host device or Device Under Test).

2.6 Additional configuration requirements

2.6.1 Live Streaming transmission configuration

Some test cases need that a live streaming is generated during test case execution.

If possible, the Test System will avoid the need of using an external camera by replacing the default camera app with a video/image file streamer. This way, a more accurate control over the conditions of what is streamed will be obtained.

If the option of replacing the camera app is not available (e.g. due to limitation of the specific OS), the live streaming will be generated as defined in the figure below:
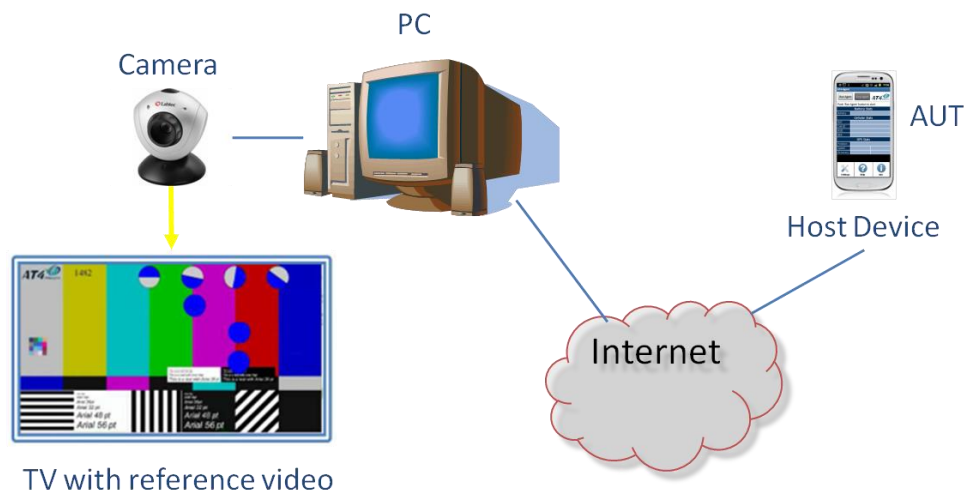
Figure 4 – Live streaming transmission configuration

Personal Computer (or equivalent hardware) connected to an Internet wide band connection.

Camera with video resolution no less than 1080p@30fps connected to the PC.

Live Streaming Services Reference App to stream live videos with operative account valid for live streaming transmission.

The camera will be recording a reference video (RTVP*n*) in a properly illuminated room.

2.6.2 Content distribution Streaming Services Reference App

When using Content distribution Streaming Services Reference App following configuration will be used:

- Videos to be played will be configured as following:
  - o Quality: Automatic.
  - o Speed: Standard.
  - o Full Screen.
  - o Following videos will be used for video transmission when using YouTube.
  - o Content Distribution Reference video 1 (muted): https://www.youtube.com/watch?v=CHO5Irn5u6o.
  - o Content Distribution Reference video 2 (with audio): https://www.youtube.com/watch?v=bBgcsYOPgs8.

2.6.3 Reference elements

The following reference elements are used in this Test Specification:

- RV1: Reference video 1 (Short duration video):
- RV2: Reference video 2 (Medium duration video):
- RV3: Reference video 3 (Long duration video (at least 30 minutes)):
- RP1: Reference picture 1 (Small size picture):
- RP2: Reference picture 2 (Medium size picture):
- RP3: Reference picture 3 (Large size picture):
- RC1: Reference comment 1: "The rain in Spain stays mainly in the plain."
- RL1: Reference location 1:
- RF1: Reference file 1 (Small size file):
- RF2: Reference file 2 (Medium size file):
- RF3: Reference file 3 (Large size file):
- RF4: Reference file 4 (Large size file):

- RF5: Reference file 5 (Large size file):
- RF6: Reference file 6 (Large size file):
- RVE1: Reference Virtual Experience 1:
- RTVP1: Reference Fixed TV Pattern 1:
- RTVP2: Reference TV Pattern 2 (High definition):

3   Management of SUT

During a test case execution, it is required that the System Under Test perform a set of required actions, so that the corresponding measurements can be obtained. These actions are known as:

- In the case of Apps, the *Application User Flow*;

- In the case of mobile phones, *Reference Apps APIs actions* (the actions to be performed by reference apps are handled by reference APIs) and,

- In the case of IoT devices, the IoT device shall provide an *IoT Device Control Interface* to allow the test case request the IoT device perform such actions

3.1   Applications and mobile devices.

Table 7 contains a list of the common *Application User Flows* and *Reference Apps API actions* to be used by Applications and mobile devices test cases respectively.

Table 7 –Application User Flows and Reference Apps API actions

Identifier	Use Case	Application User Flow
1.1	All	Reopen the App 1. Open the App. 2. Perform login step and wait for 5 seconds. 3. Close App and wait for 5 seconds 4. Open the App (no login required).
1.2	All	Navigate menu 1. Open the App. 2. Perform login step and wait for 5 seconds. 3. Enter all available menu options and views. 4. Close the App.
1.3	All	Login 1. Perform login step and wait for 5 seconds.
2.1	CS	Play three reference videos: 1. Perform login step and wait for 10 seconds. 2. Play sequentially the three reference videos: RV1, RV2 and RV3.
2.2	CS	Play and pause 1. Perform login step and wait for 10 seconds. 2. Start playing RV3 during 10 seconds. 3. Pause the reproduction. 4. Resume the reproduction after 2 minutes
2.3	CS	Rewind and Fast Forward

		1. Perform login step and wait for 10 seconds.
		2. Start playing RV3 for 10 seconds.
		3. Perform fast forward during 2 minutes (select X8 speed if supported by the App (ICSA_CSFastForwardX8), else select the highest speed supported).
		4. Change to normal play and keep this mode for 10 seconds.
		5. Perform rewind for 2 minutes (select X8 speed if supported by the App (ICSA_CSRewindX8), else select the highest rewind speed supported),
		6. Stop the playback.
2.4	CS	Download a media file 1. Perform login step and wait for 10 seconds. 2. Download RV3. 3. Wait until the download is complete.
2.5	CS	Set background state. 1. Perform login step and wait for 10 seconds. 2. Set the App in background state. 3. Wait for 20 minutes 4. Set the App in active state
2.6	CS	Play and Stop 1. Perform login step and wait for 10 seconds. 2. Start playing RV3. 3. Stop the reproduction after 1 minute. 4. Resume the reproduction after 1 minutes
2.7	CS	Search and Seek 1. Perform login step and wait for 10 seconds. 2. Search reference file RV3. 3. Start playing RV3. 4. Seek the player at 15 minutes position.
2.8	CS	Skip forward and backward 1. Perform login step and wait for 10 seconds. 2. Start playing RV2. 3. After 1 minute, skip backward to the beginning of the media file. 4. After 20 seconds, skip forward to the next media file (RV3). 5. After 5 seconds, skip backward to the previous media file (RV2).
3.1	LS	Play an live video from a known user 1. Perform login step and wait for 10 seconds.

		2. Select to play the live video set up in the test case initial conditions.
3.2	LS	Broadcast live video 1. Perform login step and wait for 10 seconds. 2. Broadcast live video
4.1	SN	Post comments 1. Perform login step and wait for 10 seconds. 2. Post reference comment: RC1. 3. Post reference comment: RC2. 4. Post reference comment: RC3.
4.2	SN	Post pictures 1. Perform login step and wait for 10 seconds. 2. Post sequentially the pictures: RP1, RP2 and RP3 and without any delay between the pictures. 3. Wait until the last picture is completely uploaded.
4.3	SN	Post videos 1. Perform login step and wait for 10 seconds. 2. Post sequentially the pictures: RV1, RV2 and RV3 and without any delay between videos. 3. Wait until the last video is completely uploaded.
4.4	SN	Post live video 1. Perform login step and wait for 10 seconds. 2. Post live video.
4.5	SN	Post location 1. Perform login step and wait for 10 seconds. 2. Post the reference location: RL1.
4.6	SN	Post files 1. Perform login step and wait for 10 seconds. 2. Post sequentially the reference files: RF1, RF2 and RF3. 3. Wait until all the files are completely uploaded.
4.7	SN	Get comment 1. Perform login step and wait for 10 seconds. 2. Get the first available comment.
4.8	SN	Show picture 1. Perform login step and wait for 10 seconds. 2. Get the first available picture.

4.9	SN	Play video
		1. Perform login step and wait for 10 seconds.
		2. Get the first available video.
4.10	SN	Play live video
		1. Perform login step and wait for 10 seconds.
		2. Get reference live video
4.11	SN	Get location
		1. Perform login step and wait for 10 seconds.
		2. Post sequentially the reference location: RL1.
4.12	SN	Get file
		1. Perform login step and wait for 10 seconds.
		2. Get the first available file.
4.13	SN	Search objects
		1. Perform login step and wait for 10 seconds.
		2. Search the most relevant item for which the App has been mainly designed (e.g., contacts, flights, hotels, etc.).
5.1	HS	Download three files sequentially
		1. Perform login step and wait for 10 seconds.
		2. Download sequentially the reference files: RF1, RF2 and RF3 and without any delay between them.
		3. Wait until the last file is completely downloaded.
5.2	HS	Upload three files sequentially
		1. Perform login step and wait for 10 seconds.
		2. Upload sequentially the reference files: RF1, RF2 and RF3 and without any delay between them.
		3. Wait until the last file is completely uploaded.
5.3	HS	Download several files simultaneously
		1. Perform login step and wait for 10 seconds.
		2. Download simultaneously the reference files: RF1, RF2, RF3, RF4, RF5 and RF6.
		3. Wait until the last file is completely downloaded.
5.4	HS	Upload several files simultaneously
		1. Perform login step and wait for 10 seconds.
		2. Upload simultaneously the reference files: RF1, RF2, RF3, RF4, RF5 and RF6.
		3. Wait until the last file is completely uploaded.
5.5	HS	Download a huge file

		1. Perform login step and wait for 5 seconds.
		2. Download the reference file RF7.
		3. Wait until the file is completely downloaded.
5.6	HS	Upload a huge file 1. Perform login step and wait for 5 seconds. 2. Upload the reference file RF7. 3. Wait until the last file is completely uploaded.
5.7	HS	Pause and Resume Download 1. Perform login step and wait for 10 seconds. 2. Start downloading the reference file RF7. 3. After 30 seconds, pause the file transfer. 4. Wait for 15 seconds and resume the transfer
5.8	HS	Pause and Resume Upload 1. Perform login step and wait for 10 seconds. 2. Start uploading the reference file RF7. 3. After 30 seconds, pause the file transfer. 4. Wait for 15 seconds and resume the file upload.
6.1	VR	Load Virtual Experience 1. Perform login step and wait for 10 seconds. 2. Load reference virtual experience RVE1. 3. Load until the virtual experience is completely loaded
7.1	AR	Load Augmentation layer on physical marker 1. Perform login step and wait for 10 seconds. 2. Start an augmented reality session. 3. Aim at a physical marker.
7.2	AR	Load Augmentation layer at a location 1. Perform login step and wait for 10 seconds. 2. Start an augmented reality session. 3. Aim at a specific location.
10.1	GA	Start session game 1. Perform login step and wait for 10 seconds. 2. Set most common configuration (as required) 3. Start session game
10.2	GA	Short Session game 1. Perform login step and wait for 10 seconds.

		2. Set game most common configuration.
		3. Start game.
		4. Perform standard game session for 2 minutes
10.3	GA	Large Session game
		1. Perform login step and wait for 10 seconds.
		2. Set game most common configuration.
		3. Start game.
		4. Perform standard game session for 15 minutes
10.4	GA	Pause and resume game
		1. Perform login step and wait for 5 seconds.
		2. Set game most common configuration.
		3. Start game session.
		4. After 2 minutes set the session in pause mode.
		5. After 30 seconds, resume the game session.
10.5	GA	Start saved session game
		1. Perform login step and wait for 5 seconds.
		2. Set game most common configuration.
		3. Start game session.
		4. After 2 minutes save game session data.
		Note: Some Apps may need a longer time to allow saving game session.
		5. Exit the game session.
		6. After 10 seconds restart the saved game session.
		7. After 20 seconds, exit the game session.
10.6	GA	Start two game sessions
		1. Perform login step and wait for 10 seconds.
		2. Set most common configuration (as required).
		3. Start a new session game.
		4. After 1 minute, exit the game session.
		5. Exit the game session and wait for 15 seconds.
		6. Start a new session game.
		7. After 15 seconds, exit the game session.

3.2 IoT devices

The IUT will provide an *IoT device Control Interface* to allow TRIANGLE testbed perform the following actions on it. IUTs shall implement the actions related to supported ICS.

Table 8 – Control Interface functionality

ICS	Action	Description
ICSDI_RecordVideo	Send live video streaming	Transmit a live video streaming
ICSDI_RecordAudio	Send live audio streaming	Transmit a live audio streaming
ICSDI_PlayVideo	Receive live video streaming	Play a live video streaming'
ICSDI_PlayAudio	Receive live audio streaming'	Play a live audio streaming'

4 Application Test cases

4.1 Application User Experience (AUE)

4.1.1 Common Services

The tests cases in this section apply to all Use Cases.

4.1.1.1 Open the App

Identifier: *AUE/CO/001*

Title: Open the App

Objective: Verify that the AUT performs the login and logout actions properly.

Applicability:

(ICSG_ProductType = Application) AND ICSA_Login

Initial Conditions:

AUT is in [AUT-NOT-RUNNING] mode.

Steps:

1. The Test System commands the AUT to replay the Application User Flow 1.1: Reopen the app.

2. The Test System measures the time from initiating the App to starting using the App when login is required and when login is not required.

3. The Test System measures whether de AUT has been unintentionally interrupted or not.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- Open Access Time: The time elapsed from initiating the AUT when login is required to starting using the App.

- Re-open Access Time: The time elapsed from initiating the AUT when login is not required to starting using the App.

- Access Operation: Access the application when user intends to use the application to close it.

- Application Cut-Off: Probability that the AUT is interrupted without being done intentionally by the user.

4.1.1.2 Menu Navigation

Identifier: *AUE/CO/002*

Title: Menu Navigation

Objective: Verify that the AUT does not crash when the user navigates throughout the AUT menu tree.

Applicability:

(ICSG_ProductType = Application) AND ICSA_Login

Initial Conditions:

AUT is in [AUT-NOT-RUNNING] mode.

Steps:

1. The Test System commands the AUT to replay the Application User Flow 1.2: Navigate menu

2. The Test System measures the time from initiating the App to starting using the App, and whether the AUT could be used or not (as would be intended by a user).

3. The Test System measures whether de AUT has been unintentionally interrupted or not.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- Access Time: The time elapsed from initiating the AUT to starting using the App.

- Access Operation: Access the application when user intends to use the application.

- Application Cut-Off: Probability that the AUT is interrupted without being done intentionally by the user.

4.1.2   CS Content Distribution Streaming Services

Note: The following test cases are defined to prevent any device-side content caching which the AUT could implement. However, if the AUT Backend Service also implements a server-side caching (e.g., storing the current playback time for a user), preventing that effect is left to the implementation of the test case.

4.1.2.1 Non Interactive Playback

Identifier: *AUE/CS/001*

Title: Non Interactive Playback

Objective: Measure the user experience KPIs by the AUT while executing the feature media file playing from the Content Distribution Streaming Services use case.

Applicability:

(ICSG_ProductType = Application) AND (ICSG_UseCases includes CS) AND ICSA_CSPlay

Initial Conditions:

AUT is in [AUT STARTED] mode.

Steps:

1. The Test System commands the AUT to replay the Application User Flow 2.1: Play three reference media files.

2. The Test System measures the initial buffering, the number and duration of re-buffering occurrences and the video resolution.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- Time to load first media frame: The time elapsed since the user clicks play button until the media reproduction starts.

- Playback Cut-off: Probability that successfully started stream reproduction is ended by a cause other than the intentional termination by the user.

- Content Stall (s): The elapsed duration of content stalls while playing the content.

- Video resolution: Used video resolution.

4.1.2.2 Play and Pause

Identifier: *AUE/CS/002*

Title: Play and Pause

Objective: Measure the ability of the AUT to pause and the resume a media file.

Applicability:

(ICSG_ProductType = Application) AND (ICSG_UseCases includes CS) AND ICSA_CSPause

Initial Conditions:

AUT is in [AUT STARTED] mode.

Steps:

1. The Test System commands the AUT to replay the Application User Flow 2.2: Play and Pause.

2. The Test System measures whether pause operation was successful or not.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- Playback Cut-off: Probability that successfully started stream reproduction is ended by a cause other than the intentional termination by the user.

- Pause Operation: Whether pause operation is successful or not.

- Time to load first media frame (s) after resuming: The time elapsed since the user clicks resume button until the media reproduction starts.

4.1.2.3 Stop and Replay

Identifier: *AUE/CS/003*

Title: Stop and replay

Objective: Measure the ability of the AUT to stop and the re-play a media file.

Applicability:

(ICSG_ProductType = Application) AND (ICSG_UseCases includes CS)

Initial Conditions:

AUT is in [AUT STARTED] mode.

Steps:

1. The Test System commands the AUT to replay the Application User Flow 2.6: Stop and Replay.

2. The Test System measures whether stop re-play operations were successful or not.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- Time to load first media frame: The time elapsed since the user clicks play button until the media reproduction starts.

- Playback Cut-off**:** Probability that successfully started stream reproduction is ended by a cause other than the intentional termination by the user.

- Stop Operation: Whether stop operation is successful or not.

4.1.2.4 Search and Seek

Identifier: *AUE/CS/004*

Title: Media file Seek

Objective: Measure the ability of the AUT to search a media file and seek at any time in the media file.

Applicability:

(ICSG_ProductType = Application) AND (ICSG_UseCases includes CS) AND ICSA_CSSearchSeek

Initial Conditions:

AUT is in [AUT STARTED] mode.

Steps:

1. The Test System commands the AUT to replay the Application User Flow 2.7: Search and Seek.

2. The Test System measures the search time and the time to load the first media frame after the seek operation.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- Search Time: The time elapsed since the user clicks search button until the first search result is shown.

- Playback Cut-off: Probability that successfully started stream reproduction is ended by a cause other than the intentional termination by the user.

- Time to load first frame: The time elapsed since the user clicks play button until reproduction resumes after seek operation.

- Search Operation: Whether the search was successful or not

4.1.2.5 Rewind

Identifier: *AUE/CS/005*

Title: Rewind

Objective: Measure the ability of the AUT to perform rewind and fast forward operations while playing a media file.

Applicability:

(ICSG_ProductType = Application) AND (ICSG_UseCases includes CS) AND ICSA_CSRewind

Initial Conditions:

AUT is in [AUT STARTED] mode.

Steps:

1. The Test System commands the AUT to replay the Application User Flow 2.9: Rewind.
2. The Test System measures the time to load the first media frame after the rewind operation.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- Playback cut-off: Probability that successfully started stream reproduction is ended by a cause other than the intentional termination by the user.

- Time to load first media frame: The average of the time elapsed since the user clicks play button until reproduction resumes after rewind operation.

- Rewind operation: Whether rewind operation is successful or not.

4.1.2.6 Playlist Skip Forward and Backward

Identifier: *AUE/CS/006*

Title: Playlist Skip Forward and Backward

Objective: Measure the ability of the AUT to skip forward and backward through a playlist while playing a media file.

Applicability:

(ICSG_ProductType = Application) AND (ICSG_UseCases includes CS) AND ICSA_CSSkipForward AND ICSA_CSSkipBackward

Initial Conditions:

AUT is in [AUT STARTED] mode.

Steps:

1. The Test System commands the AUT to replay the Application User Flow 2.8: Skip Forward and Backward.

2. The Test System measures the time to load the first media frame after the first skip backward operation.

3. The Test System measures the time to load the first media frame after the first skip forward operation.

4. The Test System measures the time to load the first media frame after the second skip backward operation.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- Video Playback cut-off: Probability that successfully started stream reproduction is ended by a cause other than the intentional termination by the user.

- Time to load first media frame: The time elapsed since the user clicks play button until reproduction resumes after rewind and fast forward operations.

- Skip Forwards Operation: Measures whether the skip forwards is successful

- Skip Backwards Operation: Measures whether the skip backwards is successful

4.1.2.7 Download content for offline playing

Identifier: *AUE/CS/007*

Title: Download content for offline playing

Objective: Measure the ability of the AUT to download a media file for offline playing.

Applicability:

(ICSG_ProductType = Application) AND (ICSG_UseCases includes CS) AND ICSA_CSDownloadMedia

Initial Conditions:

AUT is in [AUT STARTED] mode.

Steps:

1. The Test System commands the AUT to replay the Application User Flow 2.4: Download a media file.

2. The Test System measures the time to download load the media file.

3. The Test System commands the AUT to delete the media file.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- Media Download Operation: Whether the download operation is successful or not.

- File Downloading Time: The time elapsed since the user clicks download button until the media reproduction is ready to be started.

4.1.2.8 Fast Forward

Identifier: *AUE/CS/008*

Title: Fast Forward

Objective: Measure the ability of the AUT to perform rewind and fast forward operations while playing a media file.

Applicability:

(ICSG_ProductType = Application) AND (ICSG_UseCases includes CS) AND ICSA_CSFastForward

Initial Conditions:

AUT is in [AUT STARTED] mode.

Steps:

1. The Test System commands the AUT to replay the Application User Flow 2.10: Fast Forward.

2. The Test System measures the time to load the first media frame after the fast forward operation.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- Playback cut-off: Probability that successfully started stream reproduction is ended by a cause other than the intentional termination by the user.

- Time to load first media frame: The average of the time elapsed since the user clicks play button until reproduction resumes after fast forward operation.

- Fast forward operation: Whether fast forward operation is successful or not.

4.1.3 Live Streaming Services

4.1.3.1 Play Live Video from User

Identifier: *AUE/LS/001*

Title: Play Live Video from User

Objective: Measure the user experience KPIs by the AUT while executing the feature live video playing from the Live Streaming Services use case.

Applicability:

(ICSG_ProductType = Application) AND (ICSG_UseCases includes LS)

Initial Conditions:

- AUT is in [AUT STARTED] mode.

- An Internet connected PC transmits live video as defined in section 2.6.1.

Steps:

1. The Test System commands the AUT to replay the Application User Flow 3.1: Playing live video from a known user.

2. The Test System measures the initial buffer, the number of stall occurrences and the video resolution.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- Time to load first picture**:** The time elapsed since the user clicks play button until AUT starts playing the selected broadcast source.

- Broadcasting Reproduction Cut-off**:** Probability that successfully started broadcast reproduction is ended by a cause other than the intentional termination by the AUT user.

- Content Stall (s): The elapsed duration of content stalls while playing the selected broadcast source.

- Video resolution: Used video resolution.

4.1.3.2 Broadcast Live Video

Identifier: *AUE/LS/002*

Title: Broadcast Live Video to User

Objective: Measure the capability of broadcasting live content.

Applicability:

(ICSG_ProductType = Application) AND (ICSG_UseCases includes LS)

Initial Conditions:

- AUT is in [AUT STARTED] mode.

- The Host Device camera is focused on a TV displaying reference video RTVP2.

Steps:

1. The Test Systems starts playing RTVP2 on the TV.

2. The Test System commands the AUT to replay the Application User Flow 3.2: Broadcast live video.

3. The Test System receives the broadcasted video from the AUT and measures the number of stall occurrences and the video resolution.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- Time to load receive first picture**:** The time elapsed since the user clicks broadcast button until the Test System starts playing the AUT broadcast video.

- Broadcasting Reproduction Cut-off**:** Probability that successfully started broadcast reproduction is ended by a cause other than the intentional termination by the AUT user.

- Content Stall (s): The elapsed duration of content stalls while broadcasting the content.

- Video resolution: Used video resolution.

4.1.4 Social Networking

4.1.4.1 Picture Posting

Identifier: *AUE/SN/001*

Title: Picture Posting

Objective: Measure the user experience KPIs by the AUT while executing the feature picture uploading in the Social Networking use case.

Applicability:

(ICSG_ProductType = Application) AND (ICSG_UseCases includes SN) AND ICSA_SNPostImage

Initial Conditions:

AUT is in [AUT STARTED] mode.

Steps:

1. The Test System commands the AUT to replay the Application User Flow 4.2: Uploading three reference pictures separately.

2. The Test System measures the time to successfully upload each of the pictures, and whether each upload was successful or not.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- Picture Upload Operation: Whether the upload operation is successful or not.

- Picture Upload Time: The time elapsed since the user clicks upload button until the picture is stored in the AUT Backend Service.

4.1.4.2 Video Posting

Identifier: *AUE/SN/002*

Title: Video Posting

Objective: Measure the user experience KPIs by the AUT while executing the feature video uploading in the Social Networking use case.

Applicability:

(ICSG_ProductType = Application) AND (ICSG_UseCases includes SN) AND ICSA_SNPostVideo

Initial Conditions:

AUT is in [AUT STARTED] mode.

Steps:

1. The Test System commands the AUT to replay the Application User Flow 4.3: Post videos sequentially.

2. The Test System measures the time to successfully upload each of the video clips, and whether each upload was successful or not.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- Video Upload Operation: Whether the upload operation is successful or not.

- Video Upload Time: The time elapsed since the user clicks upload button until the video clip is stored in the AUT Backend Service.

4.1.4.3 Comment Posting

Identifier: *AUE/SN/003*

Title: Comment Uploading

Objective: Measure the user experience KPIs by the AUT while executing the feature comment uploading in the Social Networking use case.

Applicability:

(ICSG_ProductType = Application) AND (ICSG_UseCases includes SN) AND ICSA_SNPostComment

Initial Conditions:

AUT is in [AUT STARTED] mode.

Steps:

1. The Test System commands the AUT to replay the Application User Flow 4:1: Uploading three reference comments separately.

2. The Test System measures the time to successfully upload each of the comment, and whether each upload was successful or not.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- Comment Upload Operation: Whether the upload operation is successful or not.

- Comment Upload Time: The time elapsed since the user clicks upload button until the comment is stored in the AUT Backend Service.

4.1.4.4 File Posting

Identifier: *AUE/SN/004*

Title: File Uploading

Objective: Measure the user experience KPIs by the AUT while executing the feature file posting in the Social Networking use case.

Applicability:

(ICSG_ProductType = Application) AND (ICSG_UseCases includes SN) AND ICSA_SNPostFile.

Initial Conditions:

AUT is in [AUT STARTED] mode.

Steps:

1. The Test System commands the AUT to replay the Application User Flow 4.6: Post three reference files separately.
2. The Test System measures the time to successfully upload each of the files, and whether each upload was successful or not.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- File Upload Operation: Whether the upload operation is successful or not.
- File Upload Time: The time elapsed since the user clicks upload button until the file is stored in the AUT Backend Service.

4.1.4.5 Show Picture

Identifier: *AUE/SN/005*

Title: Show picture

Objective: Measure the user experience KPIs by the AUT while executing the feature show picture in the Social Networking use case.

Applicability:

(ICSG_ProductType = Application) AND (ICSG_UseCases includes SN) AND ICSA_SNGetImage

Initial Conditions:

AUT is in [AUT STARTED] mode.

Steps:

1. The Test System commands the AUT to replay the Application User Flow 4.8: Show three reference pictures.

2. The Test System measures the time to successfully download and show each of the pictures, and whether each download was successful or not.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- Show Picture Operation: Whether the download operation is successful or not.

- Show Picture Time: The time elapsed since the user clicks download button until the picture is shown.

4.1.4.6 Play Video

Identifier: *AUE/SN/006*

Title: Play Video

Objective: Measure the user experience KPIs by the AUT while executing the feature play video in the Social Networking use case.

Applicability:

(ICSG_ProductType = Application) AND (ICSG_UseCases includes SN) AND ICSA_SNGetVideo

Initial Conditions:

AUT is in [AUT STARTED] mode.

Steps:

1. The Test System commands the AUT to replay the Application User Flow 4.9 Play three reference videos.

2. The Test System measures the initial buffer, the number of re-buffering and the content resolution.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- Time to load first media frame: The time elapsed since the user clicks play button until the media reproduction starts.

- Playback Cut-off Ratio: Probability that successfully started stream reproduction is ended by a cause other than the intentional termination by the user.

- Content Stalling: The elapsed duration of content stalling while playing the content.

- Video resolution: Used video resolution.

4.1.4.7 File Downloading

Identifier: *AUE/SN/007*

Title: File Downloading

Objective: Measure the user experience KPIs by the AUT while executing the feature file downloading in the Social Networking use case.

Applicability:

(ICSG_ProductType = Application) AND (ICSG_UseCases includes SN) AND ICSA_SNGetFile

Initial Conditions:

AUT is in [AUT STARTED] mode.

Steps:

1. The Test System commands the AUT to replay the Application User Flow 4.12: Downloading three reference flies.

2. The Test System measures the time to successfully download each of the files, and whether each download was successful or not.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- File Download Operation: Whether the download operation is successful or not.

- File Download Time: The time elapsed since the user clicks download button until the file is stored in the Host Device.

4.1.4.8 Play Live Video from User

Identifier: *AUE/SN/008*

Title: Play Live Video from User

Objective: Measure the user experience KPIs by the AUT while playing a live video from a user.

Applicability:

(ICSG_ProductType = Application) AND (ICSG_UseCases includes SN)

Initial Conditions:

AUT is in [AUT STARTED] mode.

Steps:

1. The Test System commands the AUT to replay the Application User Flow 4.10: Play live video from a user.

2. The Test System measures the initial buffer, the number of re-buffering and the content resolution.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- Time to load first media frame: The time elapsed since the user clicks play button until the media reproduction starts.

- Playback Cut-off: Probability that successfully started stream reproduction is ended by a cause other than the intentional termination by the user.

- Content Stalling: The elapsed duration of content stalling while playing the content.

- Video resolution: Used video resolution.

4.1.4.9 Search Object

Identifier: *AUE/SN/009*

Title: Search Object

Objective: Measure the ability of the AUT to search the most relevant item for which the AUT has been mainly designed (e.g., contacts, flights, hotels, etc.).

Applicability:

(ICSG_ProductType = Application) AND (ICSG_UseCases includes SN)

Initial Conditions:

AUT is in [AUT STARTED] mode.

Steps:

1. The Test System commands the AUT to replay the Application User Flow 4.13: Search object.
2. The Test System measures the search time.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- Search Time: The time elapsed since the user clicks search button until the first search result is shown.

- Search Operation: Whether the search operation is successful or not.

4.1.5 High Speed Internet

4.1.5.1 Downloading files sequentially

Identifier: *AUE/HS/001*

Title: Downloading files sequentially

Objective: Measure the user experience KPIs by the AUT while executing the feature file downloading in the High Speed Internet use case.

Applicability:

(ICSG_ProductType = Application) AND (ICSG_UseCases includes HS)

Initial Conditions:

AUT is in [AUT STARTED] mode.

Steps:

1. The Test System commands the AUT to replay the Application User Flow 5.1: Download three reference flies.

2. The Test System measures the time to successfully download each of the files, and whether each download was successful or not.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- File Download Operation: Whether the download operation is successful or not.

- File Download Time: The time elapsed since the user clicks download button until the file is stored in the Host Device.

4.1.5.2 Uploading files sequentially

Identifier: *AUE/HS/002*

Title: Uploading files sequentially

Objective: Measure the user experience KPIs by the AUT while executing the feature file uploading in the High Speed Internet use case.

Applicability:

(ICSG_ProductType = Application) AND (ICSG_UseCases includes HS)

Initial Conditions:

AUT is in [AUT STARTED] mode.

Steps:

1. The Test System commands the AUT to replay the Application User Flow 5.2: Upload three reference flies.

2. The Test System measures the time to successfully upload each of the files, and whether each upload was successful or not.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- File Upload Operation: Whether the upload operation is successful or not.

- File Upload Time: The time elapsed since the user clicks upload button until the file is stored in the AUT Backend Service.

4.1.5.3 Pause and Resume Download Transfer

Identifier: *AUE/HS/003*

Title: Pause and Resume Download Transfer

Objective: Measure the ability of the AUT to pause and resume a file download.

Applicability:

(ICSG_ProductType = Application) AND (ICSG_UseCases includes HS)

Initial Conditions:

AUT is in [AUT STARTED] mode.

Steps:

1. The Test System commands the AUT to replay the Application User Flow 5.7 Pause and Resume one reference media file download.

2. The Test System measures whether the pause operation and the resume operation were successful or not.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- File Pause Download Operation: Whether the pause download operation is successful or not.

- File Resume Download Operation: Whether the resume download operation is successful or not.

4.1.5.4 Pause and Resume Upload Transfer

Identifier: *AUE/HS/004*

Title: Pause and Resume Upload Transfer

Objective: Measure the ability of the AUT to pause and resume a file upload.

Applicability:

(ICSG_ProductType = Application) AND (ICSG_UseCases includes HS)

Initial Conditions:

AUT is in [AUT STARTED] mode.

Steps:

1. The Test System commands the AUT to replay the Application User Flow 5.8 Pause and Resume one reference media file upload.

2. The Test System measures whether the pause operation and the resume operation were successful or not.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- File Pause Upload Operation: Whether the pause upload operation is successful or not.

- File Resume Upload Operation: Whether the resume upload operation is successful or not.

4.1.6 Virtual Reality

4.1.6.1 Virtual Experience Loading

Identifier: *AUE/VR/001*

Title: Virtual Experience Loading

Objective: Measure the ability of the AUT to look around with three degrees of movement freedom from a single observation point.

Applicability:

(ICSG_ProductType = Application) AND (ICSG_UseCases includes VR)

Initial Conditions:

AUT is in [AUT STARTED] mode.

Steps:

1. The Test System commands the AUT to replay the Application User Flow 6.1 Select a virtual experience.
2. The Test System measures the time to recognize the target object.
3. The Test System spins up the Host Device 30 degrees.
4. The Test System measures the time to recognize the target object.
5. The Test System spins down the Host Device 60 degrees.
6. The Test System measures the time to recognize the target object.
7. The Test System spins up the Host Device 30 degrees and spins left 60 degrees.
8. The Test System measures the time to recognize the target object.
9. The Test System spins right the Host Device 120 degrees.
10. The Test System measures the time to recognize the target object.
11. The Test System spins left 60 degrees.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- Time to load the virtual world: Time elapsed from selecting a scenario (world, experience, etc.) to loading the 3D visual context.

- Immersion Cut-off: Probability that successfully started immersion is ended by a cause other than the intentional termination by the user.

4.1.6.2 Virtual Scene Loading

Identifier: *AUE/VR/002*

Title: Virtual Scene Loading

Objective: Measure the ability of the AUT to move horizontally from the initial observation point under the user control.

Applicability:

(ICSG_ProductType = Application) AND (ICSG_UseCases includes VR)

Initial Conditions:

AUT is in [AUT STARTED] mode.

Steps:

1. The Test System commands the AUT to replay the Application User Flow 6.1 Select a virtual experience.
2. The Test System waits until the target object is recognized.
3. The Test System spins up the Host Device a random number of degrees between 10 and 50.
4. The Test System waits until the target object is recognized.
5. The Test System commands the AUT to move horizontally (walking speed, 4 km/h) during 20 seconds in order to change the scene.
6. The Test System measures the time to recognize the target object.
7. The Test System spins back the Host Device to the original position.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- Time to load the virtual scene: Time elapsed from selecting an scenario (world, experience, etc.) to loading the 3D visual context.
- Immersion Cut-off: Probability that successfully started immersion is ended by a cause other than the intentional termination by the user.
- Video resolution: Used frame resolution.

4.1.7 Augmented Reality

4.1.7.1 Load Augmentation Layer on Physical Marker

Identifier: *AUE/AR/001*

Title: Load Augmentation Layer on physical marker

Objective: Measure the performance of the AUT to render a virtual layer on top of a moving physical marker.

Applicability:

(ICSG_ProductType = Application) AND (ICSG_UseCases includes AR)

Initial Conditions:

AUT is in [AUT STARTED] mode.

Steps:

1. The Test System commands the AUT to replay the Application User Flow 7.1 Load augmentation layer on a physical marker.

2. The Test System forces the Host Device to aim at a physical maker.

3. The Test System measures the time elapsed by the AUT to display a virtual layer on top of the physical marker.

4. The Test System spins (in any direction) the Host Device 30 degrees, while the physical marker remains in the same position.

5. The Test System measures whether the AUT keeps showing the virtual layer on top of the physical virtual or not.

6. The Test System spins back to the original position.

7. The Test System measures whether the AUT keeps showing the virtual layer on top of the physical marker or not.

8. The Test System commands the AUT to exit augmented reality mode.

9. The Test System measures whether the AUT clears up the virtual layer or not.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- Time to load augmentation: Time elapsed from aiming the device at physical marker to displaying the virtual layer on top of it.

- Augmentation Cut-off: Probability that successfully started immersion is ended by a cause other than the intentional termination by the user.

- Clear Augmentation Layer Operation: Whether the clear virtual operation is successful or not.

4.1.7.2 Load Augmentation Layer at Location

Identifier: *AUE/AR/002*

Title: Load Augmentation Layer at specific location

Objective: Measure the performance of the AUT to render a virtual layer at a specific location.

Applicability:

(ICSG_ProductType = Application) AND (ICSG_UseCases includes AR)

Initial Conditions:

AUT is in [AUT STARTED] mode.

Steps:

1. The Test System commands the AUT to replay the Application User Flow 7.2 Load augmentation layer at a specific location.

2. The Test System forces the Host Device to be set at specific position.

3. The Test System measures the time elapsed by the AUT to display a virtual layer at the current location.

4. The Test System commands the AUT to exit augmented reality mode.

5. The Test System measures whether the AUT clears up the virtual layer from the Host Device screen or not.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- Time to load augmentation: Time elapsed from setting the Host Device at a specfic locaiton to displaying the virtual layer.

- Augmentation Cut-off: Probability that successfully started immersion is ended by a cause other than the intentional termination by the user.

- Clear Augmentation Layer Operation: Whether the clear virtual operation is successful or not.

4.1.8 Gaming

4.1.8.1 Start new game sessions

Identifier: *AUE/GA/001*

Title: Start new game sessions

Objective: Measure the ability of the AUT to start new game sessions.

Applicability:

(ICSG_ProductType = Application) AND (ICSG_UseCases includes GA)

Initial Conditions:

- AUT is in [AUT STARTED] mode.

- AUT options are configured to their default values.

- Any AUT screen saving option is disabled.

- AUT resolution is configured to maximum resolution available.

- AUT Music and sound effects are configured to be ON.

- No energy saving option is enabled in the AUT.

Steps:

1. The Test System commands the AUT to replay the Application User Flow 10.6: Start two game sessions.

2. The Test System measures the time to successfully start the game session the first time (including connection to server and loading).

3. The Test System measures the time to successfully start the game a second time.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- Time to load the game: The time elapsed since the user clicks play button until the AUT loads the game session and the user can start the interaction with the Host Device for playing.

- Start Game Operation: Whether the game session is successfully loaded or not.

- Time to load the second game: The time elapsed since the user clicks play button until the AUT loads the game session the second time and the user can start the interaction with the Host Device for playing.

- Start Game Operation: Whether the second game session is successfully loaded or not.

4.1.8.2 Long Game session

Identifier: *AUE/GA/002*

Title: Long game session

Objective: Measure the ability of the AUT to play a game session.

Applicability:

(ICSG_ProductType = Application) AND (ICSG_UseCases includes GA)

Initial Conditions:

- AUT is in [AUT STARTED] mode.

- AUT options are configured to their default values.

- Any AUT screen saving option is disabled.

- AUT resolution is configured to maximum resolution available.

- AUT Music and sound effects are configured to be ON.

- No energy saving option is enabled in the AUT.

Steps:

1. The Test System commands the AUT to replay the Application User Flow 7.3: Play long gaming session. The application user flow must last at least 5 minutes.

2. The Test System measures the number of times and the duration that the game session stalls and the content resolution.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- Game Cut-off: Probability that successfully started gaming session ends due to a cause other than the intentional termination by the user.

- Game Content Stall: The elapsed duration of content stalling while executing the gaming session.

- Video resolution: Used video resolution.

4.1.8.3 Pause and Resume

Identifier: *AUE/GA/003*

Title: Pause and resume

Objective: Measure the ability of the AUT to pause and the resume a game session.

Applicability:

(ICSG_ProductType = Application) AND (ICSG_UseCases includes GA) AND ICSA_GAPause

Initial Conditions:

- AUT is in [AUT STARTED] mode.

- AUT options are configured to their default values.

- Any AUT screen saving option is disabled.

- AUT resolution is configured to maximum resolution available.

- AUT Music and sound effects are configured to be ON.

- No energy saving option is enabled in the AUT.

Steps:

1. The Test System commands the AUT to replay the Application User Flow 10.4: Pause and resume a game session.

2. The Test System measures whether pause operation and the resume operation were successful or not during step1.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- Pause Operation: Whether pause operation is successful or not.

- Resume Operation: Whether resume operation is successful or not.

- Time to load game session after resuming: The time elapsed since the user clicks resume button until the AUT user can resume the interaction with the Host Device for playing.

4.1.8.4 Start saved game session

Identifier: *AUE/GA/004*

Title: Start saved game session

Objective: Measure the ability of the AUT to start a saved game session.

Applicability:

(ICSG_ProductType = Application) AND (ICSG_UseCases includes GA) AND ICSA_GASaveGame

Initial Conditions:

- AUT is in [AUT STARTED] mode.

- AUT options are configured to their default values.

- Any AUT screen saving option is disabled.

- AUT resolution is configured to maximum resolution available.

- AUT Music and sound effects are configured to be ON.

- No energy saving option is enabled in the AUT.

Steps:

1. The Test System commands the AUT to replay the Application User Flow 10.5: Saved game session.

2. The Test System measures the time to successfully start the game when starting the saved game version (including connection to server and loading).

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- Time to load the game: The time elapsed since the user clicks play button until the AUT loads the saved game session and the user can start the interaction with the Host Device for playing.

- Start Game Operation: Whether the saved game session is successfully loaded or not.

4.2 Device Resources Usage (RES)

4.2.1 Common test cases

The tests cases in this section apply to all Use Cases.

4.2.1.1 Device ON

Identifier: RES*/CO/001*

Title: Device ON

Objective: Verify the Host Device resources usage when app is not installed and there is no app installed (other than default apps installed in the host device).

Applicability:

(ICSG_ProductType = Application)

Initial Conditions:

AUT is in [AUT NOT RUNNING] mode.

Steps:

1. The Test System measures the Host Device use of resources during 20 minutes.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- **Average Memory usage:** Average amount of memory used during the measurement in MB.

- **Average CPU usage:** Average percentage of CPU used during the measurement.

- **Average GPU usage:** Average percentage of GPU used during the measurement.

4.2.1.2 Open the App

Identifier: RES*/CO/002*

Title: Open the App

Objective: Measure the AUT usage of the Host Device resources when the AUT is started, and logged in, and then closed and started again.

Applicability:

(ICSG_ProductType = Application) AND ICSA_Login

Initial Conditions:

AUT is in [AUT NOT RUNNING] mode.

Steps:

1. The Test System commands the AUT to replay the Application User Flow 1.1: Reopen the App.

2. The Test System measures the use of Host Device resources from initiating the App to closing and reopening it again.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- **App opening average Memory usage:** Average amount of memory used during the measurement in MB.

- **App opening average CPU usage:** Average percentage of CPU used during the measurement.

- **App opening average GPU usage:** Average percentage of GPU used during the measurement.

4.2.1.3 Background state

Identifier: RES*/CO/003*

Title: Background state

Objective: Measure the usage of device resources of the AUT when it is in background state.

Applicability:

(ICSG_ProductType = Application)

Initial Conditions:

AUT is in [AUT STARTED] mode.

Steps:

1. The Test System commands the AUT to replay the Application User Flow 1.3: Login.

2. The Test Systems sets the AUT in background state.

3. The Test System performs the measurements defined below with the AUT in background state.

4. The Test Systems sets the AUT back in active state.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- **Average Memory usage:** Average amount of memory used in background mode for 20 minutes.

- **Average CPU usage:** Average percentage of CPU used in background mode for 20 minutes.

4.2.2 CS Content Distribution Streaming Services

4.2.2.1 Non Interactive Playback

Identifier: RES*/CS/001*

Title: Non Interactive Playback

Objective: Measure the usage of device resources of the AUT when executing the feature media file playing.

Applicability:

(ICSG_ProductType = Application) AND (ICSG_UseCases includes CS)

Initial Conditions:

AUT is in [AUT STARTED] mode.

Steps:

1. The Test System commands the AUT to replay the Application User Flow 2.1: Play three reference media files.

2. The Test System measures the use of Host Device resources during the reproduction of the three reference videos.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- **Playback average Memory usage:** Average amount of memory used during the measurement in MB.

- **Playback average CPU usage:** Average percentage of CPU used during the measurement.

- **Playback average GPU usage:** Average percentage of GPU used during the measurement.

4.2.2.2 Play and Pause

Identifier: *RES/CS/002*

Title: Play and Pause

Objective: Measure the usage of device resources of the AUT when a media file is in pause mode.

Applicability:

(ICSG_ProductType = Application) AND (ICSG_UseCases includes CS) AND ICSA_CSPause.

Initial Conditions:

AUT is in [AUT STARTED] mode.

Steps:

1. The Test System commands the AUT to replay the Application User Flow 2.2: Play and pause.

2. The Test System measures the use of Host Device resources while the reproduction is in pause mode.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- **Pause average Memory usage:** Average amount of memory used during the measurement in MB.

- **Pause average CPU usage:** Average percentage of CPU used during the measurement.

- **Pause average GPU usage:** Average percentage of GPU used during the measurement.

4.2.2.3 Rewind

Identifier: RES*/CS/003*

Title: Rewind

Objective: Measure the usage of device resources of the AUT when performing rewind operation while playing a media file.

Applicability:

(ICSG_ProductType = Application) AND (ICSG_UseCases includes CS) AND ICSA_CSRewind

Initial Conditions:

AUT is in [AUT STARTED] mode.

Steps:

1. The Test System commands the AUT to replay the Application User Flow 2.9: Rewind.

2. The Test System measures the use of Host Device resources while the AUT is in rewind mode.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- **Rewind average Memory usage:** Average amount of memory used in MB while the reproduction is in rewind mode.

- **Rewind average CPU usage:** Average percentage of CPU used while the reproduction is in rewind mode.

- **Rewind average GPU usage:** Average percentage of GPU used while the reproduction is in rewind mode.

4.2.2.4 Download content for offline playing

Identifier: RES*/CS/004*

Title: Download content for offline playing

Applicability:

(ICSG_ProductType = Application) AND (ICSG_UseCases includes CS) AND ICSA_CSDownloadMedia

Initial Conditions:

AUT is in [AUT STARTED] mode.

Steps:

1. The Test System commands the AUT to replay the Application User Flow 2.4: Download a media file.

2. The Test System measures the use of Host Device resources while media file is being downloaded.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- **Downloading content average Memory usage:** Average amount of memory used in MB while thereference file is being downloaded.

- **Downloading content average CPU usage:** Average percentage of CPU used while thereference file is being downloaded.

- **Downloading content average GPU usage:** Average percentage of GPU used while thereference file is being downloaded.

4.2.2.5 Non Interactive Playback with screen off

Identifier: RES*/CS/005*

Title: Non Interactive Playback with screen off

Objective: Measure the usage of device resources of the AUT while executing the feature media file playing from the Content Distribution Streaming Services use case and the screen is turned off.

Applicability:

(ICSG_ProductType = Application) AND (ICSG_UseCases includes CS)

Initial Conditions:

AUT is in [AUT STARTED] mode.

Host Device and/or AUT may need to be configured so it can replay videos with screen off (e.g. Host device configured to send the video reproduction to an external screen)

Steps:

1. The Test System commands the AUT to replay the Application User Flow 2.1: Play three reference media files.

2. Five seconds after the start of step 1, the Test Systems turns the Host Device screen off and waits for 5 seconds.

3. The Test System measures the usage of device resources of the AUT while the Host Device is with the screen off and the video is being played.

Postamble:

- The Test System turns the Host Device screen ON.

- Execute the Postamble sequence (see section 2.5).

Measurements:

- **Screen off playback average Memory usage:** Average amount of memory used during the measurement in MB.

- **Screen off playback average CPU usage:** Average percentage of CPU used during the measurement.

- **Screen off playback average GPU usage:** Average percentage of GPU used during the measurement.

4.2.2.6 Fast Forward

Identifier: RES*/CS/006*

Title: Fast Forward

Objective: Measure the usage of device resources of the AUT when performing Fast Forward operation while playing a media file.

Applicability:

(ICSG_ProductType = Application) AND (ICSG_UseCases includes CS) AND ICSA_CS FastForward

Initial Conditions:

AUT is in [AUT STARTED] mode.

Steps:

1. The Test System commands the AUT to replay the Application User Flow 2.10: Fast Forward.

2. The Test System measures the use of Host Device resources while the AUT is in fast forward mode.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- **Fast forward average Memory usage:** Average amount of memory used in MB while the reproduction is in fast forward mode.

- **Fast forward average CPU usage:** Average percentage of CPU used while the reproduction is in fast forward mode.

- **Fast forward average GPU usage:** Average percentage of GPU used while the reproduction is in fast forward mode.

4.2.3 Live Streaming Services

4.2.3.1 Play Live Video from User

Identifier: RES*/LS/001*

Title: Play Live Video from User

Objective: Measure the usage of device resources of the AUT while executing the feature live video playing from the Live Streaming Services use case.

Applicability:

(ICSG_ProductType = Application) AND (ICSG_UseCases includes LS)

Initial Conditions:

- AUT is in [AUT STARTED] mode.

- A live video is generated as defined in section 2.6.1.

Steps:

1. The Test System commands the AUT to replay the Application User Flow 3.1: Play a live video.

2. The Test System measures the use of Host Device resources during the reproduction of the live video streaming in step 1.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- **Live video from user average Memory usage:** Average amount of memory used during the measurement in MB.

- **Live video from user average CPU usage:** Average percentage of CPU used during the measurement.

- **Live video from user average GPU usage:** Average percentage of GPU used during the measurement.

4.2.3.2 Broadcast Live Video

Identifier: *RES/LS/002*

Title: Broadcast Live Video to User

Objective: Measure the usage of device resources of the AUT when broadcasting live content.

Applicability:

(ICSG_ProductType = Application) AND (ICSG_UseCases includes LS).

Initial Conditions:

- AUT is in [AUT STARTED] mode.

- The Host Device camera is focused on the fixed TV pattern RTVP1.

Steps:

1. The Test System commands the AUT to replay the Application User Flow 3.2: Broadcast live video.

2. The Test System measures the use of Host Device resources during the reproduction of the live video streaming.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- **Live video average Memory usage:** Average amount of memory in MB used during the measurement.

- **Live video average CPU usage:** Average percentage of CPU used during the measurement.

- **Live video average GPU usage:** Average percentage of GPU used during the measurement.

4.2.3.3 Broadcast live video with screen off

Identifier: *AEC/LS/003*

Title: Broadcast live video with screen off

Objective: Measure the usage of device resources of the AUT while executing the feature broadcast a live video from the Live Streaming Services use case when the screen is turned off.

Applicability:

(ICSG_ProductType = Application) AND (ICSG_UseCases includes LS) AND ICSA_LSBroadcastScreenOff

Initial Conditions:

- AUT is in [AUT STARTED] mode.
- The Host Device camera is focused on the fixed TV pattern RTVP1.

Steps:

1. The Test System commands the AUT to replay the Application User Flow 3.2: Broadcast live video.

2. Five seconds after the start of step 1, the Test Systems turns the Host Device screen off and waits for 5 seconds.

3. The Test System measures the use of Host Device resources after completion of step 2 and during 10 minutes.

Postamble:

- The Test System turns the Host Device screen on.
- Execute the Postamble sequence (see section 2.5).

Measurements:

- **Screen off live video average Memory usage:** Average amount of memory used during the measurement in MB.

- **Screen off live video average CPU usage:** Average percentage of CPU used during the measurement.

- **Screen off live video average GPU usage:** Average percentage of GPU used during the measurement.

4.2.4 Social Networking

4.2.4.1 Picture Posting

Identifier: *RES/SN/001*

Title: Picture Posting

Objective: Measure the usage of device resources of the AUT while executing the feature picture posting in the Social Networking use case.

Applicability:

(ICSG_ProductType = Application) AND (ICSG_UseCases includes SN) AND ICSA_SNPostImage

Initial Conditions:

AUT is in [AUT STARTED] mode.

Steps:

1. The Test System commands the AUT to replay the Application User Flow 4.2: Post pictures.

2. The Test System measures the use of Host Device resources while the pictures are being posted.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- **Post image average Memory usage:** Average amount of memory in MB used during the measurement

- **Post image average CPU usage:** Average percentage of CPU used during the measurement.

- **Post image average GPU usage:** Average percentage of GPU used during the measurement.

4.2.4.2 Video Posting

Identifier: *RES/SN/002*

Title: Video Uploading

Objective: Measure the usage of device resources of the AUT while executing the feature vdeo posting in the Social Networking use case.

Applicability:

(ICSG_ProductType = Application) AND (ICSG_UseCases includes SN) AND ICSA_SNPostVideo

Initial Conditions:

AUT is in [AUT STARTED] mode.

Steps:

1. The Test System commands the AUT to replay the Application User Flow 4.3: Post videos sequentially.

2. The Test System measures the use of Host Device resources while the videos are being posted.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- **Post video average Memory usage:** Average amount of memory in MB used during the measurement

- **Post video average CPU usage:** Average percentage of CPU used during the measurement.

- **Post video average GPU usage:** Average percentage of GPU used during the measurement.

4.2.4.3 File Posting

Identifier: *RES/SN/003*

Title: File Posting

Objective: Measure the usage of device resources of the AUT while executing the feature file posting in the Social Networking use case.

Applicability:

(ICSG_ProductType = Application) AND (ICSG_UseCases includes SN) AND ICSA_SNPostFile.

Initial Conditions:

AUT is in [AUT STARTED] mode.

Steps:

1. The Test System commands the AUT to replay the Application User Flow 4.6: Post three reference files separately.

2. The Test System measures the use of Host Device resources while the files are being posted.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- **Post file average Memory usage:** Average amount of memory in MB used during the measurement

- **Post file average CPU usage:** Average percentage of CPU used during the measurement.

- **Post file average GPU usage:** Average percentage of GPU used during the measurement.

4.2.4.4 Show Picture

Identifier: *RES/SN/004*

Title: Show Picture

Objective: Measure the usage of device resources of the AUT while executing the feature show picture in the Social Networking use case.

Applicability:

(ICSG_ProductType = Application) AND (ICSG_UseCases includes SN) AND ICSA_SNGetImage

Initial Conditions:

AUT is in [AUT STARTED] mode.

Steps:

1. The Test System commands the AUT to replay the Application User Flow 4.8: Show three reference pictures.

2. The Test System measures the use of Host Device resources while each picture is being downloaded and shown.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- **Show picture average Memory usage:** Average amount of memory in MB used during the measurement

- **Show picture average CPU usage:** Average percentage of CPU used during the measurement.

- **Show picture average GPU usage:** Average percentage of GPU used during the measurement.

4.2.4.5 Play Video

Identifier: *RES/SN/005*

Title: Play Video

Objective: Measure the usage of device resources of the AUT while executing the feature Play video in the Social Networking use case.

Applicability:

(ICSG_ProductType = Application) AND (ICSG_UseCases includes SN) AND ICSA_SNGetVideo

Initial Conditions:

AUT is in [AUT STARTED] mode.

Steps:

1. The Test System commands the AUT to replay the Application User Flow 4.9 Play three reference videos.

2. The Test System measures the use of Host Device resources while the videos are being played.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- **Play video average Memory usage:** Average amount of memory in MB used during the measurement

- **Play video average CPU usage:** Average percentage of CPU used during the measurement.

- **Play video average GPU usage:** Average percentage of GPU used during the measurement.

4.2.5 File Downloading

Identifier: *RES/SN/006*

Title: File Downloading

Objective: Measure the usage of device resources of the AUT while executing the feature file downloading in the Social Networking use case.

Applicability:

(ICSG_ProductType = Application) AND (ICSG_UseCases includes SN) AND ICSA_SNGetFile

Initial Conditions:

AUT is in [AUT STARTED] mode.

Steps:

1. The Test System commands the AUT to replay the Application User Flow 4.12: Downloading three reference flies.

2. The Test System measures the use of Host Device resources while the files are being downloaded.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- **Get file average Memory usage:** Average amount of memory in MB used during the measurement

- **Get file average CPU usage:** Average percentage of CPU used during the measurement.

- **Get file average GPU usage:** Average percentage of GPU used during the measurement.

4.2.6 High Speed Internet

4.2.6.1 Downloading files sequentially

Identifier: *RES/ HS/001*

Title: Downloading files sequentially

Objective: Measure the usage of device resources of the AUT while executing the feature downloading files sequentially in the High Speed Internet use case.

Applicability:

(ICSG_ProductType = Application) AND (ICSG_UseCases includes HS)

Initial Conditions:

AUT is in [AUT STARTED] mode.

Steps:

1. The Test System commands the AUT to replay the Application User Flow 5.1: Download three reference flies.

2. The Test System measures the use of Host Device resources while the files are being downloaded.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- **File download average Memory usage:** Average amount of memory in MB used during the measurement

- **File download average CPU usage:** Average percentage of CPU used during the measurement.

- **File download average GPU usage:** Average percentage of GPU used during the measurement.

4.2.6.2 Uploading files sequentially

Identifier: *RES/HS/002*

Title: Uploading files sequentially

Objective: Measure the usage of device resources of the AUT while executing the feature uploading files sequentially in the High Speed Internet use case.

Applicability:

(ICSG_ProductType = Application) AND (ICSG_UseCases includes HS)

Initial Conditions:

AUT is in [AUT STARTED] mode.

Steps:

1. The Test System commands the AUT to replay the Application User Flow 5.2: Upload three reference flies.

2. The Test System measures the use of Host Device resources while the files are being uploaded.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- **File upload average Memory usage:** Average amount of memory in MB used during the measurement

- **File upload average CPU usage:** Average percentage of CPU used during the measurement.

- **File upload average GPU usage:** Average percentage of GPU used during the measurement.

4.2.6.3 Downloading several files simultaneously

Identifier: *RES/HS/003*

Title: Downloading several files simultaneously

Objective: Measure the usage of device resources of the AUT while executing the feature downloading several files simultaneously in the High Speed Internet use case.

Applicability:

(ICSG_ProductType = Application) AND (ICSG_UseCases includes HS)

Initial Conditions:

AUT is in [AUT STARTED] mode.

Steps:

1. The Test System commands the AUT to replay the Application User Flow 5.3: Download several reference flies simultaneously.

2. The Test System measures the use of Host Device resources while the files are being downloaded.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- **Average Memory usage:** Average amount of memory in MB used during the measurement
- **Average CPU usage:** Average percentage of CPU used during the measurement.
- **Average GPU usage:** Average percentage of GPU used during the measurement.

4.2.6.4 Uploading several files simultaneously

Identifier: *RES/HS/004*

Title: Uploading several files simultaneously

Objective: Measure the usage of device resources of the AUT while executing the feature uploading several files simultaneously in the High Speed Internet use case.

Applicability:

(ICSG_ProductType = Application) AND (ICSG_UseCases includes HS)

Initial Conditions:

AUT is in [AUT STARTED] mode.

Steps:

1. The Test System commands the AUT to replay the Application User Flow 5.4: Upload several reference flies simultaneously.
2. The Test System measures the use of Host Device resources while the files are being uploaded.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- **Average Memory usage:** Average amount of memory in MB used during the measurement
- **Average CPU usage:** Average percentage of CPU used during the measurement.
- **Average GPU usage:** Average percentage of GPU used during the measurement.

4.2.6.5 Downloading a file with screen off

Identifier: *RES/HS/005*

Title: Downloading a file with screen off

Objective: Measure the usage of device resources of the AUT while executing the feature downloading a file in the High Speed Internet use case with the screen off.

Applicability:

(ICSG_ProductType = Application) AND (ICSG_UseCases includes HS)

Initial Conditions:

AUT is in [AUT STARTED] mode.

Steps:

1. The Test System commands the AUT to replay the Application User Flow 5.5: Download a huge file.

2. Five seconds after the start of step 1, the Test System starts measuring the use of Host Device resources while the file is being downloaded.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- **Average Memory usage:** Average amount of memory in MB used during the measurement

- **Average CPU usage:** Average percentage of CPU used during the measurement.

- **Average GPU usage:** Average percentage of GPU used during the measurement.

4.2.6.6 Uploading a file with screen off

Identifier: *RES/HS/006*

Title: Uploading a file with screen off

Objective: Measure the usage of device resources of the AUT while executing the feature uploading a file in the High Speed Internet use case with the screen off.

Applicability:

(ICSG_ProductType = Application) AND (ICSG_UseCases includes HS)

Initial Conditions:

AUT is in [AUT STARTED] mode.

Steps:

1. The Test System commands the AUT to replay the Application User Flow 5.6: Upload a huge file.

2. Five seconds after the start of step 1, The Test System starts measuring the use of Host Device resources while the file is being uploaded.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- **Average Memory usage:** Average amount of memory in MB used during the measurement

- **Average CPU usage:** Average percentage of CPU used during the measurement.

- **Average GPU usage:** Average percentage of GPU used during the measurement.

4.2.7 Virtual Reality

4.2.7.1 Virtual Experience Loading

Identifier: *RES/VR/001*

Title: Virtual Experience Loading

Objective: Measure the usage of device resources of the AUT while loading a Virtual experience from a single point.

Applicability:

(ICSG_ProductType = Application) AND (ICSG_UseCases includes VR)

Initial Conditions:

- AUT is in [AUT STARTED] mode.

Steps:

1. The Test System commands the AUT to replay the Application User Flow 6.1 Select a virtual experience.

2. The Test System waits until the AUT recognizes the target object

3. The Test System spins up the Host Device 30 degrees, and waits until the AUT recognizes the target object.

4. The Test System spins down the Host Device 60 degrees and waits until the AUT recognizes the target object.

5. The Test System spins up the Host Device 30 degrees and spins left 60 degrees and waits until the AUT recognizes the target object.

6. The Test System spins right the Host Device 120 degrees and waits until the AUT recognizes the target object.

7. The Test System spins left 60 degrees and waits until the AUT recognizes the target object.

8. The Test System measures the use of the Host Device resources from step 1 to step 7.

9. The Test System spins back the Host Device to the original position.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- **Experience loading average Memory usage:** Average amount of memory in MB used during the measurement

- **Experience loading average CPU usage:** Average percentage of CPU used during the measurement.

- **Experience loading average GPU usage:** Average percentage of GPU used during the measurement.

4.2.7.2 Virtual Scene Loading

Identifier: *RES/VR/002*

Title: Virtual Scene Loading

Objective: Measure the usage of device resources of the AUT while moving horizontally from the initial observation point under the user control.

Applicability:

(ICSG_ProductType = Application) AND (ICSG_UseCases includes VR)

Initial Conditions:

AUT is in [AUT STARTED] mode.

Steps:

1. The Test System commands the AUT to replay the Application User Flow 6.1 Select a virtual experience.

2. The Test System waits until the target object is recognized.

3. The Test System spins up the Host Device a random number of degrees between 10 and 50.

4. The Test System waits until the target object is recognized.

5. The Test System commands the AUT to move horizontally (walking speed, 4 km/h) during 20 seconds in order to change the scene.

6. The Test System measures use of Host Device resources during step 5 execution.

7. The Test System spins back the Host Device to the original position.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- **Scene loading average Memory usage:** Average amount of memory in MB used during the measurement

- **Scene loading average CPU usage:** Average percentage of CPU used during the measurement.

- **Scene loading average GPU usage:** Average percentage of GPU used during the measurement.

4.2.8 Augmented Reality

4.2.8.1 Load augmentation layer on a physical marker

Identifier: *RES/AR/001*

Title: Load augmentation layer on a physical marker

Objective: Measure the usage of device resources of the AUT to render a virtual layer on top of a moving physical marker.

Applicability:

(ICSG_ProductType = Application) AND (ICSG_UseCases includes AR)

Initial Conditions:

AUT is in [AUT STARTED] mode.

Steps:

1. The Test System commands the AUT to replay the Application User Flow 7.1 Load augmentation layer on a physical marker.

2. The Test System measures the use of Host Device resources until the App displays a virtual layer on top of the physical marker.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- **Average Memory usage:** Average amount of memory in MB used during the measurement

- **Average CPU usage:** Average percentage of CPU used during the measurement.

- **Average GPU usage:** Average percentage of GPU used during the measurement.

4.2.8.2 Load Augmentation Layer at Location

Identifier: *RES/AR/002*

Title: Load Augmentation Layer at location

Objective: Measure the usage of device resources of the AUT to render a virtual layer at an specific location.

Applicability:

(ICSG_ProductType = Application) AND (ICSG_UseCases includes AR)

Initial Conditions:

AUT is in [AUT STARTED] mode.

Steps:

1. The Test System commands the AUT to replay the Application User Flow 7.2 Load augmentation layer at an specific location.

2. The Test System measures the use of Host Device resources until the App displays a virtual layer at the location specified.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- **Average Memory usage:** Average amount of memory in MB used during the measurement
- **Average CPU usage:** Average percentage of CPU used during the measurement.
- **Average GPU usage:** Average percentage of GPU used during the measurement.

4.2.8.3 Augmented reality session

Identifier: *RES/AR/003*

Title: Augmented reality session

Objective: Measure the usage of device resources of the AUT when performing an augmented reality session.

Applicability:

(ICSG_ProductType = Application) AND (ICSG_UseCases includes AR)

Initial Conditions:

AUT is in [AUT STARTED] mode.

Steps:

1. The Test System commands the AUT to replay the Application User Flow 7.1 Load augmentation layer on a physical marker.
2. The Test System spins (in one of the three axis) the Host Device 15 degrees, while the physical marker remains in the same position.
3. The Test Systems wait for 5 seconds
4. The Test System measures the use of Host Device resources in steps 2 and 3, and whether the AUT keeps showing the virtual layer on top of the physical marker.
5. The Test System spins in the same axis the Host Device 30 degrees in the opposite direction, while the physical marker remains in the same position.
6. The Test Systems wait for 5 seconds
7. The Test System measures the use of Host Device resources in steps 5 and 6 and whether the AUT keeps showing the virtual layer on top of the physical virtual.
8. The Test System spins the Host device back to the original position.
9. The Test System spins back to the original position.
10. The Test System repeat steps 2 to 9 in the other two axis.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- **AR session average Memory usage:** Average amount of memory in MB used during the measurement

- **AR session average CPU usage:** Average percentage of CPU used during the measurement.

- **AR session average GPU usage:** Average percentage of GPU used during the measurement.

4.2.9 Gaming

4.2.9.1 Start Game session

Identifier: *RES/GA/001*

Title: Start game session

Objective: Measure the usage of device resources of the AUT while starting a game session.

Applicability:

(ICSG_ProductType = Application) AND (ICSG_UseCases includes GA)

Initial Conditions:

- AUT is in [AUT STARTED] mode.

- AUT options are configured to their default values.

- Any AUT screen saving option is disabled.

- AUT resolution is configured to maximum resolution available.

- AUT Music and sound effects are configured to be ON.

- No energy saving option is enabled in the AUT.

Steps:

1. The Test System commands the AUT to replay the Application User Flow 10.1: Start game session.

2. The Test System measures the use of Host Device resources while the game session is being started.

Postamble:

- Execute the Postamble sequence (see section 2.5).

- **Measurements:**

- **Game session start average Memory usage:** Average amount of memory in MB used during the measurement

- **Game session start average CPU usage:** Average percentage of CPU used during the measurement.

- **Game session start average GPU usage:** Average percentage of GPU used during the measurement.

4.2.9.2 Short Game session

Identifier: *RES/GA/002*

Title: Short Game session

Objective: Measure the usage of device resources of the AUT while playing a short game session.

Applicability:

(ICSG_ProductType = Application) AND (ICSG_UseCases includes LS)

Initial Conditions:

- AUT is in [AUT STARTED] mode.
- AUT options are configured to their default values.
- Any AUT screen saving option is disabled.
- AUT resolution is configured to maximum resolution available.
- AUT Music and sound effects are configured to be ON.
- No energy saving option is enabled in the AUT.

Steps:

1. The Test System commands the AUT to replay the Application User Flow 7.2: Short game session.
2. The Test System measures the use of Host Device resources while the game session is being played.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- **Short Game session average Memory usage:** Average amount of memory in MB used during the measurement
- **Short Game session average CPU usage:** Average percentage of CPU used during the measurement.
- **Short Game session average GPU usage:** Average percentage of GPU used during the measurement.

4.2.9.3 Long Game session

Identifier: *RES/GA/003*

Title: Long Game session

Objective: Measure the usage of device resources of the AUT while playing a long game session.

Applicability:

(ICSG_ProductType = Application) AND (ICSG_UseCases includes LS)

Initial Conditions:

- AUT is in [AUT STARTED] mode.

- AUT options are configured to their default values.

- Any AUT screen saving option is disabled.

- AUT resolution is configured to maximum resolution available.

- AUT Music and sound effects are configured to be ON.

- No energy saving option is enabled in the AUT.

Steps:

1. The Test System commands the AUT to replay the Application User Flow 7.3: Long game session.

2. The Test System measures the use of Host Device resources while the game session is being played.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- **Long Game session average Memory usage:** Average amount of memory in MB used during the measurement

- **Long Game session average CPU usage:** Average percentage of CPU used during the measurement.

- **Long Game session average GPU usage:** Average percentage of GPU used during the measurement.

4.3   Energy consumption (AEC)

4.3.1 Common

The tests cases in this section apply to all Use Cases.

4.3.1.1 Device ON

Identifier: AEC*/CO/001*

Title: Device ON

Objective: Measure the energy that is consumed by the Host Device when the AUT is not running.

Applicability:

(ICSG_ProductType = Application)

Initial Conditions:

AUT is in [AUT NOT RUNNING] mode.

Steps:

2. The Test System measures the current consumption during 20 minutes with the AUT not running and the device switched on.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- Current consumption: Record current samples during the measurement time and calculate the following values:
  - o Average current consumption.
  - o Standard deviation

4.3.1.2 Open the app

Identifier: AEC*/CO/002*

Title: Login and log out

Objective: Measure the energy that is consumed by the Host Device when the AUT is started, and logged in, and then closed and started again.

Applicability:

(ICSG_ProductType = Application) AND ICSA_Login

Initial Conditions:

AUT is in [AUT NOT RUNNING] mode.

Steps:

3. The Test System commands the AUT to replay the Application User Flow 1.1: Reopen the App.

4. The Test System measures the current consumption from initiating the App to closing it and reopening again.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- Current consumption: Record current samples during the measurement time and calculate the following values:
  - o Average current consumption.
  - o Standard deviation

4.3.1.3 Background state

Identifier: AEC*/CO/003*

Title: Background state

Objective: Measure the energy that is consumed by the AUT when it is in background state.

Applicability:

(ICSG_ProductType = Application)

Initial Conditions:

AUT is in [AUT STARTED] mode.

Steps:

5. The Test System commands the AUT to replay the Application User Flow 1.1: Reopen the App.

6. The Test Systems sets the AUT in background state.

7. The Test System performs the measurements defined below during 20 minutes with the AUT in background state.

8. The Test Systems sets the AUT back in active state.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- Current consumption: Record current samples during the measurement time and calculate the following values:
    - Average current consumption.
    - Standard deviation

4.3.2 CS Content Distribution Streaming Services

Note: The following test cases are defined to prevent any device-side content caching which the AUT could implement. However, if the AUT Backend Service also implements a server-side caching (e.g., storing the current playback time for an user), preventing that effect is left to the implementation of the test case.

4.3.2.1 Non Interactive Playback

Identifier: *AEC/CS/001*

Title: Non Interactive Playback

Objective: Measure the energy that is consumed by an AUT while executing the feature media file playing from the Content Distribution Streaming Services use case.

Applicability:

(ICSG_ProductType = Application) AND (ICSG_UseCases includes CS)

Initial Conditions:

AUT is in [AUT STARTED] mode.

Steps:

3. The Test System commands the AUT to replay the Application User Flow 2.1: Play three reference media files.

4. The Test System measures the current consumed during the reproduction of the three reference videos.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- Current consumption: Record current samples during the measurement time and calculate the following values:
    - o Average current consumption.
    - o Standard deviation

4.3.2.2 Play and Pause

Identifier: *AEC/CS/002*

Title: Play and Pause

Objective: Measure the energy that is consumed by an AUT when a media file is in pause mode.

Applicability:

(ICSG_ProductType = Application) AND (ICSG_UseCases includes CS) AND ICSA_CSPause

Initial Conditions:

AUT is in [AUT STARTED] mode.

Steps:

1. The Test System commands the AUT to replay the Application User Flow 2.2: Play and pause.

2. The Test System measures the current consumed during the period the reference video is in Pause mode.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- Current consumption: Record current samples during the measurement time and calculate the following values:
    - o Average current consumption.
    - o Standard deviation

4.3.3 Rewind

Identifier: *AEC/CS/003*

Title: Rewind

Objective: Measure the energy that is consumed by an AUT when performing rewind operation while playing a media file.

Applicability:

(ICSG_ProductType = Application) AND (ICSG_UseCases includes CS) AND ICSA_CSRewind

Initial Conditions:

AUT is in [AUT STARTED] mode.

Steps:

1. The Test System commands the AUT to replay the Application User Flow 2.9: Rewind.

2. The Test System measures the current consumed while the reproduction of the reference video is in rewind mode.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- Current consumption: Record current samples during the measurement time and calculate the following values:
  - Average current consumption.
  - Standard deviation

4.3.4 Download content for offline playing

Identifier: *AEC/CS/004*

Title: Download content for offline playing

Objective: Measure the energy that is consumed by an AUT when downloading a media file for offline playing.

Applicability:

(ICSG_ProductType = Application) AND (ICSG_UseCases includes CS) AND ICSA_CSDownloadMedia

Initial Conditions:

AUT is in [AUT STARTED] mode.

Steps:

1. The Test System commands the AUT to replay the Application User Flow 2.4: Download a media file.

2. The Test System measures the current consumed while the media file is being downloaded.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- Current consumption: Record current samples during the measurement time and calculate the following values:
  - Average current consumption.
  - Standard deviation

4.3.4.1 Non Interactive Playback with screen off

Identifier: *AEC/CS/005*

Title: Non Interactive Playback with screen off

Objective: Measure the energy that is consumed by an AUT while executing the feature media file playing from the Content Distribution Streaming Services use case and the screen is turned off.

Applicability:

(ICSG_ProductType = Application) AND (ICSG_UseCases includes CS)

Initial Conditions:

AUT is in [AUT STARTED] mode.

Host Device and/or AUT may need to be configured so it can replay videos with screen off (e.g. Host device configured to send the video reproduction to an external screen)

Steps:

4. The Test System commands the AUT to replay the Application User Flow 2.1: Play three reference media files.

5. Five seconds after the start of step 1, the Test Systems turns the Host Device screen off and waits for 5 seconds.

6. The Test System measures the current consumed while the Host Device is with the screen off and the video is being played.

Postamble:

- The Test System turns the Host Device screen ON.
- Execute the Postamble sequence (see section 2.5).

Measurements:

- Current consumption: Record current samples during the measurement time and calculate the following values:
  - Average current consumption.
  - Standard deviation

4.3.4.2 Fast Forward

Identifier: *AEC/CS/006*

Title: Fast Forward

Objective: Measure the energy that is consumed by an AUT when performing fast forward operation while playing a media file.

Applicability:

(ICSG_ProductType = Application) AND (ICSG_UseCases includes CS) AND ICSA_CSFastForward

Initial Conditions:

AUT is in [AUT STARTED] mode.

Steps:

1. The Test System commands the AUT to replay the Application User Flow 2.10: Fast Forward.

2. The Test System measures the current consumed while the reproduction of the reference video is in Fast Forward mode.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- Current consumption: Record current samples during the measurement time and calculate the following values:
    - Average current consumption.
    - Standard deviation

4.3.5 Live Streaming Services

4.3.5.1 Play Live Video from User

Identifier: *AEC/LS/001*

Title: Play Live Video from User

Objective: Measure the energy that is consumed by an AUT while executing the feature live video playing from the Live Streaming Services use case.

Applicability:

(ICSG_ProductType = Application) AND (ICSG_UseCases includes LS)

Initial Conditions:

- AUT is in [AUT STARTED] mode.

- A live video is generated as defined in section 2.6.1.

Steps:

1. The Test System commands the AUT to replay the Application User Flow 3.1: Play a live video.

2. The Test System measures the current consumed during the reproduction of the live video streaming.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- Current consumption: Record current samples during the measurement time and calculate the following values:
    - Average current consumption.
    - Standard deviation.

4.3.5.2 Broadcast Live Video

Identifier: *AEC/LS/002*

Title: Broadcast Live Video to User

Objective: Measure the energy that is consumed by an AUT when broadcasting live content.

Applicability:

(ICSG_ProductType = Application) AND (ICSG_UseCases includes LS)

Initial Conditions:

- AUT is in [AUT STARTED] mode.
- The test case configuration is as defined in section 2.8.1 (Figure 3), with the Host Device camera focused on the fixed TV pattern RTVP1.

Steps:

1. The Test System commands the AUT to replay the Application User Flow 3.2: Broadcast live video.

2. The Test System measures the current consumed during the reproduction of the live video streaming.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- Current consumption: Record current samples during the measurement time and calculate the following values:
    - Average current consumption.
    - Standard deviation.

4.3.5.3 Broadcast live video with screen off

Identifier: *AEC/LS/003*

Title: Broadcast live video with screen off

Objective: Measure the energy that is consumed by an AUT while executing the feature broadcast a live video from the Live Streaming Services use case when the screen is turned off.

Applicability:

(ICSG_ProductType = Application) AND (ICSG_UseCases includes LS) AND ICSA_LSBroadcastScreenOff

Initial Conditions:

- AUT is in [AUT STARTED] mode.
- The test case configuration is as defined in section 2.8.1 (Figure 3), with the Host Device camera focused on the fixed TV pattern RTVP1.

Steps:

1. The Test System commands the AUT to replay the Application User Flow 3.2: Broadcast live video.
2. Wait for 10 seconds.
3. The Test Systems turns the Host Device screen off and waits for 5 seconds.
4. The Test System measures the current consumed after completion of step 3 during 10 minutes.

Postamble:

- The Test System turns the Host Device screen ON.
- Execute the Postamble sequence (see section 2.5).

Measurements:

- Current consumption: Record current samples during the measurement time and calculate the following values:
    - Average current consumption.
    - Standard deviation

4.3.6 Social Networking

4.3.6.1 Picture Posting

Identifier: *AEC/SN/001*

Title: Picture Posting

Objective: Measure the energy that is consumed by an AUT while executing the feature picture posting in the Social Networking use case.

Applicability:

(ICSG_ProductType = Application) AND (ICSG_UseCases includes SN) AND ICSA_SNPostImage

Initial Conditions:

AUT is in [AUT STARTED] mode.

Steps:

1. The Test System commands the AUT to replay the Application User Flow 4.2: Post pictures.

2. The Test System measures the current consumed while the pictures are being posted.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- Current consumption: Record current samples during the measurement time and calculate the following values:
  - o Average current consumption.
  - o Standard deviation.

4.3.6.2 Video Posting

Identifier: *AEC/SN/002*

Title: Video Uploading

Objective: Measure the energy that is consumed by an AUT while executing the feature vdeo posting in the Social Networking use case.

Applicability:

(ICSG_ProductType = Application) AND (ICSG_UseCases includes SN) AND ICSA_SNPostVideo

Initial Conditions:

AUT is in [AUT STARTED] mode.

Steps:

1. The Test System commands the AUT to replay the Application User Flow 4.3: Post videos sequentially.

2. The Test System measures the current consumed while the videos are being posted.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- Current consumption: Record current samples during the measurement time and calculate the following values:
  - o Average current consumption.
  - o Standard deviation.

4.3.6.3 File Posting

Identifier: *AEC/SN/003*

Title: File Posting

Objective: Measure the energy that is consumed by an AUT while executing the feature file posting in the Social Networking use case.

Applicability:

(ICSG_ProductType = Application) AND (ICSG_UseCases includes SN) AND ICSA_SNPostFile.

Initial Conditions:

AUT is in [AUT STARTED] mode.

Steps:

1. The Test System commands the AUT to replay the Application User Flow 4.6: Post three reference files separately.

2. The Test System measures the current consumed while the files are being posted.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- Current consumption: Record current samples during the measurement time and calculate the following values:
  - Average current consumption.
  - Standard deviation.

4.3.6.4 Show Picture

Identifier: *AEC/SN/004*

Title: Show Picture

Objective: Measure the energy that is consumed by an AUT while executing the feature picture downloading in the Social Networking use case.

Applicability:

(ICSG_ProductType = Application) AND (ICSG_UseCases includes SN) AND ICSA_SNGetImage

Initial Conditions:

AUT is in [AUT STARTED] mode.

Steps:

1. The Test System commands the AUT to replay the Application User Flow 4.8: Get three reference pictures.

2. The Test System measures the current consumed while the pictures are being downloaded and until the pictures are completely displayed at their final resolution.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- Current consumption: Record current samples during the measurement time and calculate the following values:
    - Average current consumption.
    - Standard deviation.

4.3.6.5 Play Video

Identifier: *AEC/SN/005*

Title: Play Video

Objective: Measure the energy that is consumed by an AUT while executing the feature play video in the Social Networking use case.

Applicability:

(ICSG_ProductType = Application) AND (ICSG_UseCases includes SN) AND ICSA_SNGetVideo

Initial Conditions:

AUT is in [AUT STARTED] mode.

Steps:

1. The Test System commands the AUT to replay the Application User Flow 4.9 Play three reference videos.
2. The Test System measures the current consumed while the videos are being played.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- Current consumption: Record current samples during the measurement time and calculate the following values:
    - Average current consumption.
    - Standard deviation.

4.3.6.6 File Downloading

Identifier: *AEC/SN/006*

Title: File Downloading

Objective: Measure the energy that is consumed by an AUT while executing the feature file downloading in the Social Networking use case.

Applicability:

(ICSG_ProductType = Application) AND (ICSG_UseCases includes SN) AND ICSA_SNGetFile

Initial Conditions:

AUT is in [AUT STARTED] mode.

Steps:

1. The Test System commands the AUT to replay the Application User Flow 4.12: Downloading three reference flies.

2. The Test System measures the current consumed while the files are being downloaded.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- Current consumption: Record current samples during the measurement time and calculate the following values:
  - Average current consumption.
  - Standard deviation.

4.3.7 High Speed Internet

4.3.7.1 Downloading files sequentially

Identifier: *AEC/ HS/001*

Title: Downloading files sequentially

Objective: Measure the energy that is consumed by an AUT while executing the feature downloading files sequentially in the High Speed Internet use case.

Applicability:

(ICSG_ProductType = Application) AND (ICSG_UseCases includes HS)

Initial Conditions:

AUT is in [AUT STARTED] mode.

Steps:

1. The Test System commands the AUT to replay the Application User Flow 5.1: Download three reference flies.

2. The Test System measures the current consumed while the files are being downloaded.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- Current consumption: Record current samples during the measurement time and calculate the following values:
  - Average current consumption.
  - Standard deviation.

4.3.7.2 Uploading files sequentially

Identifier: *AEC/ HS/002*

Title: Uploading files sequentially

Objective: Measure the energy that is consumed by an AUT while executing the feature uploading files sequentially in the High Speed Internet use case.

Applicability:

(ICSG_ProductType = Application) AND (ICSG_UseCases includes HS)

Initial Conditions:

AUT is in [AUT STARTED] mode.

Steps:

3. The Test System commands the AUT to replay the Application User Flow 5.2: Upload three reference flies.

4. The Test System measures the current consumed while the files are being uploaded.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- Current consumption: Record current samples during the measurement time and calculate the following values:
    - Average current consumption.
    - Standard deviation.

4.3.7.3 Downloading several files simultaneously

Identifier: *AEC/ HS/003*

Title: Downloading several files simultaneously

Objective: Measure the energy that is consumed by an AUT while executing the feature downloading several files simultaneously in the High Speed Internet use case.

Applicability:

(ICSG_ProductType = Application) AND (ICSG_UseCases includes HS)

Initial Conditions:

AUT is in [AUT STARTED] mode.

Steps:

1. The Test System commands the AUT to replay the Application User Flow 5.3: Download several reference flies simultaneously.

2. The Test System measures the current consumed while the files are being downloaded.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- Current consumption: Record current samples during the measurement time and calculate the following values:
    - Average current consumption.
    - Standard deviation.

4.3.7.4 Uploading several files simultaneously

Identifier: *AEC/HS/004*

Title: Uploading several files simultaneously

Objective: Measure the energy that is consumed by an AUT while executing the feature uploading several files simultaneously in the High Speed Internet use case.

Applicability:

(ICSG_ProductType = Application) AND (ICSG_UseCases includes HS)

Initial Conditions:

AUT is in [AUT STARTED] mode.

Steps:

3. The Test System commands the AUT to replay the Application User Flow 5.4: Upload several reference flies simultaneously.
4. The Test System measures the current consumed while the files are being uploaded.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- Current consumption: Record current samples during the measurement time and calculate the following values:
    - Average current consumption.
    - Standard deviation.

4.3.7.5 Downloading a file with screen off

Identifier: *AEC/ HS/005*

Title: Downloading a file with screen off

Objective: Measure the energy that is consumed by an AUT while executing the feature downloading a file in the High Speed Internet use case with the screen off.

Applicability:

(ICSG_ProductType = Application) AND (ICSG_UseCases includes HS)

Initial Conditions:

AUT is in [AUT STARTED] mode.

Steps:

1. The Test System commands the AUT to replay the Application User Flow 5.5: Download a huge file.

2. Five seconds after the start of step 1, The Test System starts measuring the current consumed while the file is being downloaded.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- Current consumption: Record current samples during the measurement time and calculate the following values:
    - Average current consumption.
    - Standard deviation.

4.3.7.6 Uploading a file with screen off

Identifier: *AEC/ HS/006*

Title: Uploading a file with screen off

Objective: Measure the energy that is consumed by an AUT while executing the feature uploading a file in the High Speed Internet use case with the screen off.

Applicability:

(ICSG_ProductType = Application) AND (ICSG_UseCases includes HS)

Initial Conditions:

AUT is in [AUT STARTED] mode.

Steps:

1. The Test System commands the AUT to replay the Application User Flow 5.6: Download a huge file.

2. Five seconds after the start of step 1, The Test System start measuring the current consumed while the file is being uploaded.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- Current consumption: Record current samples during the measurement time and calculate the following values:
    - Average current consumption.
    - Standard deviation.

4.3.8 Virtual Reality

4.3.8.1 Virtual Experience Loading

Identifier: *AEC/VR/001*

Title: Virtual Experience Loading

Objective: Measure the energy that is consumed by an AUT while loading a Virtual experience from a single point.

Applicability:

(ICSG_ProductType = Mobile device) AND (ICSG_UseCases includes VR)

Initial Conditions:

- AUT is in [AUT STARTED] mode.

Steps:

1. The Test System commands the AUT to replay the Application User Flow 6.1 Select a virtual experience.

2. The Test System waits until the AUT recognizes the target object

3. The Test System spins up the Host Device 30 degrees, and waits until the AUT recognizes the target object.

4. The Test System spins down the Host Device 60 degrees and waits until the AUT recognizes the target object.

5. The Test System spins up the Host Device 30 degrees and spins left 60 degrees and waits until the AUT recognizes the target object.

6. The Test System spins right the Host Device 120 degrees and waits until the AUT recognizes the target object.

7. The Test System spins left 60 degrees and waits until the AUT recognizes the target object.

8. The Test System measures the current consumed from step 1 to step 7.

9. The Test System spins back the Host Device to the original position.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- Current consumption: Record current samples during the measurement time and calculate the following values:
  - o Average current consumption.
  - o Standard deviation.
- Time to load the virtual experience.

4.3.8.2 Virtual Scene Loading

Identifier: *AEC/VR/002*

Title: Virtual Scene Loading

Objective: Measure the energy that is consumed by an AUT while moving horizontally from the initial observation point under the user control.

Applicability:

(ICSG_ProductType = Mobile device) AND (ICSG_UseCases includes VR)

Initial Conditions:

AUT is in [AUT STARTED] mode.

Steps:

1. The Test System commands the AUT to replay the Application User Flow 6.1 Select a virtual experience.

2. The Test System waits until the target object is recognized.

3. The Test System spins up the Host Device a random number of degrees between 10 and 50.

4. The Test System waits until the target object is recognized.

5. The Test System commands the AUT to move horizontally (walking speed, 4 km/h) during 20 seconds in order to change the scene.

6. The Test System measures the current consumed during step 5 execution.

7. The Test System spins back the Host Device to the original position.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- Current consumption: Record current samples during the measurement time and calculate the following values:
  - Average current consumption.
  - Standard deviation.

4.3.9 Augmented Reality

4.3.9.1 Load augmentation layer on a physical marker

Identifier: *AEC/AR/001*

Title: Load augmentation layer on a physical marker

Objective: Measure the energy that is consumed by an AUT to render a virtual layer on top of a moving physical marker.

Applicability:

(ICSG_ProductType = Mobile device) AND (ICSG_UseCases includes AR)

Initial Conditions:

AUT is in [AUT STARTED] mode.

Steps:

1. The Test System commands the AUT to replay the Application User Flow 7.1 Load augmentation layer on a physical marker.

2. The Test System measures the current consumed until the App displays a virtual layer on top of the physical marker.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- Current consumption: Record current samples during the measurement time and calculate the following values:
  - o Average current consumption.
  - o Standard deviation.

4.3.9.2 Load Augmentation Layer at Location

Identifier: *AEC/AR/002*

Title: Load Augmentation Layer at location

Objective: Measure the energy that is consumed by an AUT to render a virtual layer at an specific location.

Applicability:

(ICSG_ProductType = Mobile device) AND (ICSG_UseCases includes AR)

Initial Conditions:

AUT is in [AUT STARTED] mode.

Steps:

1. The Test System commands the AUT to replay the Application User Flow 7.2 Load augmentation layer at an specific location.

2. The Test System measures the current consumed until the App displays a virtual layer at the location specified.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- Current consumption: Record current samples during the measurement time and calculate the following values:
  - o Average current consumption.
  - o Standard deviation.

4.3.9.3 Augmented reality session

Identifier: *AEC/AR/003*

Title: Augmented reality session

Objective: Measure the energy that is consumed by an AUT during an augmented reality session.

Applicability:

(ICSG_ProductType = Mobile device) AND (ICSG_UseCases includes AR)

Initial Conditions:

AUT is in [AUT STARTED] mode.

Steps:

1. The Test System commands the AUT to replay the Application User Flow 7.1 Load augmentation layer on a physical marker.

2. The Test System spins (in one of the three axis) the Host Device 15 degrees, while the physical marker remains in the same position.

3. The Test Systems wait for 5 seconds

4. The Test System measures the current consumption in steps 2 and 3, and whether the AUT keeps showing the virtual layer on top of the physical marker.

5. The Test System spins in the same axis the Host Device 30 degrees in the opposite direction, while the physical marker remains in the same position.

6. The Test Systems wait for 5 seconds

7. The Test System measures the current consumption in steps 5 and 6 and whether the AUT keeps showing the virtual layer on top of the physical virtual.

8. The Test System spins the Host device back to the original position.

9. The Test System spins back to the original position.

10. The Test System repeat steps 2 to 9 in the other two axis.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- Current consumption: Record current samples during the measurement time and calculate the following values:
  - Average current consumption.
  - Standard deviation.

4.3.10 Gaming

4.3.10.1 Start Game session

Identifier: *AEC/GA/001*

Title: Start game session

Objective: Measure the energy that is consumed by an AUT while starting a game session.

Applicability:

(ICSG_ProductType = Mobile device) AND (ICSG_UseCases includes GA)

Initial Conditions:

- AUT is in [AUT STARTED] mode.

- AUT options are configured to their default values.

- Any AUT screen saving option is disabled.

- AUT resolution is configured to maximum resolution available.

- AUT Music and sound effects are configured to be ON.

- No energy saving option is enabled in the AUT.

Steps:

1. The Test System commands the AUT to replay the Application User Flow 10.1: Start game session.

2. The Test System measures the current consumed while the game session is being started.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- Current consumption: Record current samples during the measurement time and calculate the following values:

    o Average current consumption.

    o Standard deviation.

4.3.10.2 Short Game session

Identifier: *AEC/GA/002*

Title: Short Game session

Objective: Measure the energy that is consumed by an AUT while playing a short game session.

Applicability:

(ICSG_ProductType = Mobile device) AND (ICSG_UseCases includes LS)

Initial Conditions:

- AUT is in [AUT STARTED] mode.

- AUT options are configured to their default values.

- Any AUT screen saving option is disabled.

- AUT resolution is configured to maximum resolution available.

- AUT Music and sound effects are configured to be ON.

- No energy saving option is enabled in the AUT.

Steps:

1. The Test System commands the AUT to replay the Application User Flow 7.2: Short game session.

2. The Test System measures the current consumed while the game session is being played.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- Current consumption: Record current samples during the measurement time and calculate the following values:

   o Average current consumption.

   o Standard deviation.

4.3.10.3   Long Game session

Identifier: *AEC/GA/003*

Title: Long Game session

Objective: Measure the energy that is consumed by an AUT while playing a long game session.

Applicability:

(ICSG_ProductType = Mobile device) AND (ICSG_UseCases includes LS)

Initial Conditions:

- AUT is in [AUT STARTED] mode.

- AUT options are configured to their default values.

- Any AUT screen saving option is disabled.

- AUT resolution is configured to maximum resolution available.

- AUT Music and sound effects are configured to be ON.

- No energy saving option is enabled in the AUT.

Steps:

1. The Test System commands the AUT to replay the Application User Flow 7.3: Long game session.

2. The Test System measures the current consumed while the game session is being played.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- Current consumption: Record current samples during the measurement time and calculate the following values:

    o Average current consumption.

    o Standard deviation.

4.4 Reliability (REL)

4.4.1 Common Services

The tests cases in this section apply to all Use Cases.

4.4.1.1 Open the App

Identifier: REL*/CO/001*

Title: Open the App

Objective: Measure the reliability KPIs of the AUT when performing the login and logout actions.

Applicability:

(ICSG_ProductType = Application) AND ICSA_Login

Initial Conditions:

AUT is in [AUT-NOT-RUNNING] mode.

Steps:

1. The Test System commands the AUT to replay the Application User Flow 1.1: Reopen the app.

2. The Test System measures the time from initiating the App to starting using the App when login is required and when login is not required.

3. The Test System measures whether de AUT has been unintentionally interrupted or not.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- Open Access Time: The time elapsed from initiating the AUT when login is required to starting using the App.

- Re-open Access Time: The time elapsed from initiating the AUT when login is not required to starting using the App.

- Access Operation: Access the application when user intends to use the application to close it.

- Application Cut-Off: Probability that the AUT is interrupted without being done intentionally by the user.

4.4.1.2 Menu Navigation

Identifier: REL*/CO/002*

Title: Menu Navigation

Objective: Measure the reliability KPIs of the AUT when when the user navigates throughout the AUT menu tree.

Applicability:

(ICSG_ProductType = Application) AND ICSA_Login

Initial Conditions:

AUT is in [AUT-NOT-RUNNING] mode.

Steps:

1. The Test System commands the AUT to replay the Application User Flow 1.2: Navigate menu

2. The Test System measures the time from initiating the App to starting using the App, and whether the AUT could be used or not (as would be intended by a user).

3. The Test System measures whether de AUT has been unintentionally interrupted or not.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- Access Time: The time elapsed from initiating the AUT to starting using the App.

- Access Operation: Access the application when user intends to use the application.

- Application Cut-Off: Probability that the AUT is interrupted without being done intentionally by the user.

4.4.2 CS Content Distribution Streaming Services

Note: The following test cases are defined to prevent any device-side content caching which the AUT could implement. However, if the AUT Backend Service also implements a server-side caching (e.g., storing the current playback time for a user), preventing that effect is left to the implementation of the test case.

4.4.2.1 Non Interactive Playback

Identifier: REL*/CS/001*

Title: Non Interactive Playback

Objective: Measure the reliability KPIs of the AUT when executing the feature media file playing from the Content Distribution Streaming Services use case.

Applicability:

(ICSG_ProductType = Application) AND (ICSG_UseCases includes CS) AND ICSA_CSPlay

Initial Conditions:

AUT is in [AUT STARTED] mode.

Steps:

1. The Test System commands the AUT to replay the Application User Flow 2.1: Play three reference media files.

2. The Test System measures the initial buffering, the number and duration of re-buffering occurrences and the video resolution.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- Time to load first media frame: The time elapsed since the user clicks play button until the media reproduction starts.

- Playback Cut-off: Probability that successfully started stream reproduction is ended by a cause other than the intentional termination by the user.

- Content Stall (s): The elapsed duration of content stalls while playing the content.

- Video resolution: Used video resolution.

4.4.2.2 Play and Pause

Identifier: REL*/CS/002*

Title: Play and Pause

Objective: Measure the reliability KPIs of the AUT when executing the feature pause and resume a media file.

Applicability:

(ICSG_ProductType = Application) AND (ICSG_UseCases includes CS) AND ICSA_CSPause

Initial Conditions:

AUT is in [AUT STARTED] mode.

Steps:

1. The Test System commands the AUT to replay the Application User Flow 2.2: Play and Pause.

2. The Test System measures whether pause operation was successful or not.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- Playback Cut-off: Probability that successfully started stream reproduction is ended by a cause other than the intentional termination by the user.

- Pause Operation: Whether pause operation is successful or not.

- Time to load first media frame (s) after resuming: The time elapsed since the user clicks resume button until the media reproduction starts.

4.4.2.3 Stop and Replay

Identifier: REL*/CS/003*

Title: Stop and replay

Objective: Measure the reliability KPIs of the AUT when executing the feature stop and re-play a media file.

Applicability:

(ICSG_ProductType = Application) AND (ICSG_UseCases includes CS)

Initial Conditions:

AUT is in [AUT STARTED] mode.

Steps:

1. The Test System commands the AUT to replay the Application User Flow 2.6: Stop and Replay.

2. The Test System measures whether stop re-play operations were successful or not.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- Time to load first media frame: The time elapsed since the user clicks play button until the media reproduction starts.

- Playback Cut-off**:** Probability that successfully started stream reproduction is ended by a cause other than the intentional termination by the user.

- Stop Operation: Whether stop operation is successful or not.

4.4.2.4 Search and Seek

Identifier: REL*/CS/004*

Title: Media file Seek

Objective: Measure the reliability KPIs of the AUT when executing the feature search a media file and seek at any time in the media file.

Applicability:

(ICSG_ProductType = Application) AND (ICSG_UseCases includes CS) AND ICSA_CSSearchSeek

Initial Conditions:

AUT is in [AUT STARTED] mode.

Steps:

1. The Test System commands the AUT to replay the Application User Flow 2.7: Search and Seek.

2. The Test System measures the search time and the time to load the first media frame after the seek operation.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- Search Time: The time elapsed since the user clicks search button until the first search result is shown.

- Playback Cut-off: Probability that successfully started stream reproduction is ended by a cause other than the intentional termination by the user.

- Time to load first frame: The time elapsed since the user clicks play button until reproduction resumes after seek operation.

- Search Operation: Whether the search was successful or not

4.4.2.5 Rewind

Identifier: REL*/CS/005*

Title: Rewind

Objective: Measure the reliability KPIs of the AUT when executing the rewind and fast forward operations while playing a media file.

Applicability:

(ICSG_ProductType = Application) AND (ICSG_UseCases includes CS) AND ICSA_CSRewind

Initial Conditions:

AUT is in [AUT STARTED] mode.

Steps:

1. The Test System commands the AUT to replay the Application User Flow 2.9: Rewind.

2. The Test System measures the time to load the first media frame after the rewind operation.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- Playback cut-off: Probability that successfully started stream reproduction is ended by a cause other than the intentional termination by the user.

- Time to load first media frame: The average of the time elapsed since the user clicks play button until reproduction resumes after rewind operation.

- Rewind operation: Whether rewind operation is successful or not.

4.4.2.6 Playlist Skip Forward and Backward

Identifier: REL*/CS/006*

Title: Playlist Skip Forward and Backward

Objective: Measure the reliability KPIs of the AUT when executing the features skip forward and backward through a playlist while playing a media file.

Applicability:

(ICSG_ProductType = Application) AND (ICSG_UseCases includes CS) AND ICSA_CSSkipForward AND ICSA_CSSkipBackward

Initial Conditions:

AUT is in [AUT STARTED] mode.

Steps:

1. The Test System commands the AUT to replay the Application User Flow 2.8: Skip Forward and Backward.

2. The Test System measures the time to load the first media frame after the first skip backward operation.

3. The Test System measures the time to load the first media frame after the first skip forward operation.

4. The Test System measures the time to load the first media frame after the second skip backward operation.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- Video Playback cut-off: Probability that successfully started stream reproduction is ended by a cause other than the intentional termination by the user.

- Time to load first media frame: The time elapsed since the user clicks play button until reproduction resumes after rewind and fast forward operations.

- Skip Forwards Operation: Measures whether the skip forwards is successful

- Skip Backwards Operation: Measures whether the skip backwards is successful

4.4.2.7 Download content for offline playing

Identifier: REL*/CS/007*

Title: Download content for offline playing

Objective: Measure the reliability KPIs of the AUT when executing the feature download a media file for offline playing.

Applicability:

(ICSG_ProductType = Application) AND (ICSG_UseCases includes CS) AND ICSA_CSDownloadMedia

Initial Conditions:

AUT is in [AUT STARTED] mode.

Steps:

1. The Test System commands the AUT to replay the Application User Flow 2.4: Download a media file.

2. The Test System measures the time to download load the media file.

3. The Test System commands the AUT to delete the media file.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- Media Download Operation: Whether the download operation is successful or not.

- File Downloading Time: The time elapsed since the user clicks download button until the media reproduction is ready to be started.

4.4.2.8 Fast Forward

Identifier: REL*/CS/008*

Title: Fast Forward

Objective: Measure the reliability KPIs of the AUT when executing the rewind and fast forward operations while playing a media file.

Applicability:

(ICSG_ProductType = Application) AND (ICSG_UseCases includes CS) AND ICSA_CSFastForward

Initial Conditions:

AUT is in [AUT STARTED] mode.

Steps:

1. The Test System commands the AUT to replay the Application User Flow 2.10: Fast Forward.

2. The Test System measures the time to load the first media frame after the fast forward operation.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- Playback cut-off: Probability that successfully started stream reproduction is ended by a cause other than the intentional termination by the user.

- Time to load first media frame: The average of the time elapsed since the user clicks play button until reproduction resumes after fast forward operation.

- Fast forward operation: Whether fast forward operation is successful or not.

4.4.3 Live Streaming Services

4.4.3.1 Play Live Video from User

Identifier: REL*/LS/001*

Title: Play Live Video from User

Objective: Measure the reliability KPIs of the AUT when executing the feature live video playing from the Live Streaming Services use case.

Applicability:

(ICSG_ProductType = Application) AND (ICSG_UseCases includes LS)

Initial Conditions:

- AUT is in [AUT STARTED] mode.

- An Internet connected PC transmits live video as defined in section 2.6.1.

Steps:

3. The Test System commands the AUT to replay the Application User Flow 3.1: Playing live video from a known user.

4. The Test System measures the initial buffer, the number of stall occurrences and the video resolution.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- Time to load first picture**:** The time elapsed since the user clicks play button until AUT starts playing the selected broadcast source.

- Broadcasting Reproduction Cut-off**:** Probability that successfully started broadcast reproduction is ended by a cause other than the intentional termination by the AUT user.

- Content Stall (s): The elapsed duration of content stalls while playing the selected broadcast source.

- Video resolution: Used video resolution.

4.4.3.2 Broadcast Live Video

Identifier: REL*/LS/002*

Title: Broadcast Live Video to User

Objective: Measure the reliability KPIs of the AUT when broadcasting live content.

Applicability:

(ICSG_ProductType = Application) AND (ICSG_UseCases includes LS)

Initial Conditions:

- AUT is in [AUT STARTED] mode.

- The Host Device camera is focused on a TV displaying reference video RTVP2.

Steps:

1. The Test Systems starts playing RTVP2 on the TV.

2. The Test System commands the AUT to replay the Application User Flow 3.2: Broadcast live video.

3. The Test System receives the broadcasted video from the AUT and measures the number of stall occurrences and the video resolution.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- Time to load receive first picture**:** The time elapsed since the user clicks broadcast button until the Test System starts playing the AUT broadcast video.

- Broadcasting Reproduction Cut-off**:** Probability that successfully started broadcast reproduction is ended by a cause other than the intentional termination by the AUT user.

- Content Stall (s): The elapsed duration of content stalls while broadcasting the content.

- Video resolution: Used video resolution.

4.4.4   Social Networking

4.4.4.1 Picture Posting

Identifier: REL*/SN/001*

Title: Picture Posting

Objective: Measure the reliability KPIs of the AUT when executing the feature picture uploading in the Social Networking use case.

Applicability:

(ICSG_ProductType = Application) AND (ICSG_UseCases includes SN) AND ICSA_SNPostImage

Initial Conditions:

AUT is in [AUT STARTED] mode.

Steps:

1. The Test System commands the AUT to replay the Application User Flow 4.2: Uploading three reference pictures separately.

2. The Test System measures the time to successfully upload each of the pictures, and whether each upload was successful or not.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- Picture Upload Operation: Whether the upload operation is successful or not.

- Picture Upload Time: The time elapsed since the user clicks upload button until the picture is stored in the AUT Backend Service.

4.4.4.2 Video Posting

Identifier: REL*/SN/002*

Title: Video Posting

Objective: Measure the reliability KPIs of the AUT when executing the feature video uploading in the Social Networking use case.

Applicability:

(ICSG_ProductType = Application) AND (ICSG_UseCases includes SN) AND ICSA_SNPostVideo

Initial Conditions:

AUT is in [AUT STARTED] mode.

Steps:

1. The Test System commands the AUT to replay the Application User Flow 4.3: Post videos sequentially.

2. The Test System measures the time to successfully upload each of the video clips, and whether each upload was successful or not.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- Video Upload Operation: Whether the upload operation is successful or not.

- Video Upload Time: The time elapsed since the user clicks upload button until the video clip is stored in the AUT Backend Service.

4.4.4.3 Comment Posting

Identifier: REL*/SN/003*

Title: Comment Uploading

Objective: Measure the reliability KPIs of the AUT when executing the feature comment uploading in the Social Networking use case.

Applicability:

(ICSG_ProductType = Application) AND (ICSG_UseCases includes SN) AND ICSA_SNPostComment

Initial Conditions:

AUT is in [AUT STARTED] mode.

Steps:

1. The Test System commands the AUT to replay the Application User Flow 4:1: Uploading three reference comments separately.

2. The Test System measures the time to successfully upload each of the comment, and whether each upload was successful or not.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- Comment Upload Operation: Whether the upload operation is successful or not.

- Comment Upload Time: The time elapsed since the user clicks upload button until the comment is stored in the AUT Backend Service.

4.4.4.4 File Posting

Identifier: REL*/SN/004*

Title: File Uploading

Objective: Measure the reliability KPIs of the AUT when executing the feature file posting in the Social Networking use case.

Applicability:

(ICSG_ProductType = Application) AND (ICSG_UseCases includes SN) AND ICSA_SNPostFile.

Initial Conditions:

AUT is in [AUT STARTED] mode.

Steps:

1. The Test System commands the AUT to replay the Application User Flow 4.6: Post three reference files separately.

2. The Test System measures the time to successfully upload each of the files, and whether each upload was successful or not.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- File Upload Operation: Whether the upload operation is successful or not.

- File Upload Time: The time elapsed since the user clicks upload button until the file is stored in the AUT Backend Service.

4.4.4.5 Show Picture

Identifier: REL*/SN/005*

Title: Show picture

Objective: Measure the reliability KPIs of the AUT when executing the feature show picture in the Social Networking use case.

Applicability:

(ICSG_ProductType = Application) AND (ICSG_UseCases includes SN) AND ICSA_SNGetImage

Initial Conditions:

AUT is in [AUT STARTED] mode.

Steps:

1. The Test System commands the AUT to replay the Application User Flow 4.8: Show three reference pictures.

2. The Test System measures the time to successfully download and show each of the pictures, and whether each download was successful or not.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- Show Picture Operation: Whether the download operation is successful or not.

- Show Picture Time: The time elapsed since the user clicks download button until the picture is shown.

4.4.4.6 Play Video

Identifier: REL*/SN/006*

Title: Play Video

Objective: Measure the reliability KPIs of the AUT when executing the feature play video in the Social Networking use case.

Applicability:

(ICSG_ProductType = Application) AND (ICSG_UseCases includes SN) AND ICSA_SNGetVideo

Initial Conditions:

AUT is in [AUT STARTED] mode.

Steps:

1. The Test System commands the AUT to replay the Application User Flow 4.9 Play three reference videos.

2. The Test System measures the initial buffer, the number of re-buffering and the content resolution.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- Time to load first media frame: The time elapsed since the user clicks play button until the media reproduction starts.

- Playback Cut-off Ratio: Probability that successfully started stream reproduction is ended by a cause other than the intentional termination by the user.

- Content Stalling: The elapsed duration of content stalling while playing the content.

- Video resolution: Used video resolution.

4.4.5 File Downloading

Identifier: REL*/SN/007*

Title: File Downloading

Objective: Measure the reliability KPIs of the AUT when executing the feature file downloading in the Social Networking use case.

Applicability:

(ICSG_ProductType = Application) AND (ICSG_UseCases includes SN) AND ICSA_SNGetFile

Initial Conditions:

AUT is in [AUT STARTED] mode.

Steps:

1. The Test System commands the AUT to replay the Application User Flow 4.12: Downloading three reference flies.

2. The Test System measures the time to successfully download each of the files, and whether each download was successful or not.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- File Download Operation: Whether the download operation is successful or not.

- File Download Time: The time elapsed since the user clicks download button until the file is stored in the Host Device.

4.4.5.1 Play Live Video from User

Identifier: REL*/SN/008*

Title: Play Live Video from User

Objective: Measure the reliability KPIs of the AUT when playing a live video from a user.

Applicability:

(ICSG_ProductType = Application) AND (ICSG_UseCases includes SN)

Initial Conditions:

AUT is in [AUT STARTED] mode.

Steps:

1. The Test System commands the AUT to replay the Application User Flow 4.10: Play live video from a user.

2. The Test System measures the initial buffer, the number of re-buffering and the content resolution.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- Time to load first media frame: The time elapsed since the user clicks play button until the media reproduction starts.

- Playback Cut-off: Probability that successfully started stream reproduction is ended by a cause other than the intentional termination by the user.

- Content Stalling: The elapsed duration of content stalling while playing the content.

- Video resolution: Used video resolution.

4.4.5.2 Search Object

Identifier: REL*/SN/009*

Title: Search Object

Objective: Measure the reliability KPIs of the AUT when executing the feature search the most relevant item for which the AUT has been mainly designed (e.g., contacts, flights, hotels, etc.).

Applicability:

(ICSG_ProductType = Application) AND (ICSG_UseCases includes SN)

Initial Conditions:

AUT is in [AUT STARTED] mode.

Steps:

1. The Test System commands the AUT to replay the Application User Flow 4.13: Search object.

2. The Test System measures the search time.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- Search Time: The time elapsed since the user clicks search button until the first search result is shown.

- Search Operation: Whether the search operation is successful or not.

4.4.6 High Speed Internet

4.4.6.1 Downloading files sequentially

Identifier: REL*/HS/001*

Title: Downloading files sequentially

Objective: Measure the reliability KPIs of the AUT when executing the feature file downloading in the High Speed Internet use case.

Applicability:

(ICSG_ProductType = Application) AND (ICSG_UseCases includes HS)

Initial Conditions:

AUT is in [AUT STARTED] mode.

Steps:

1. The Test System commands the AUT to replay the Application User Flow 5.1: Download three reference flies.

2. The Test System measures the time to successfully download each of the files, and whether each download was successful or not.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- File Download Operation: Whether the download operation is successful or not.

- File Download Time: The time elapsed since the user clicks download button until the file is stored in the Host Device.

4.4.6.2 Uploading files sequentially

Identifier: REL*/HS/002*

Title: Uploading files sequentially

Objective: Measure the reliability KPIs of the AUT when executing the feature file uploading in the High Speed Internet use case.

Applicability:

(ICSG_ProductType = Application) AND (ICSG_UseCases includes HS)

Initial Conditions:

AUT is in [AUT STARTED] mode.

Steps:

1. The Test System commands the AUT to replay the Application User Flow 5.2: Upload three reference flies.

2. The Test System measures the time to successfully upload each of the files, and whether each upload was successful or not.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- File Upload Operation: Whether the upload operation is successful or not.

- File Upload Time: The time elapsed since the user clicks upload button until the file is stored in the AUT Backend Service.

4.4.6.3 Pause and Resume Download Transfer

Identifier: REL*/HS/003*

Title: Pause and Resume Download Transfer

Objective: Measure the reliability KPIs of the AUT when pausing and resuming a file download.

Applicability:

(ICSG_ProductType = Application) AND (ICSG_UseCases includes HS)

Initial Conditions:

AUT is in [AUT STARTED] mode.

Steps:

1. The Test System commands the AUT to replay the Application User Flow 5.7 Pause and Resume one reference media file download.

2. The Test System measures whether the pause operation and the resume operation were successful or not.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- File Pause Download Operation: Whether the pause download operation is successful or not.

- File Resume Download Operation: Whether the resume download operation is successful or not.

4.4.6.4 Pause and Resume Upload Transfer

Identifier: *REL/HS/004*

Title: Pause and Resume Upload Transfer

Objective: Measure the reliability KPIs of the AUT when pausing and resuming a file upload.

Applicability:

(ICSG_ProductType = Application) AND (ICSG_UseCases includes HS)

Initial Conditions:

AUT is in [AUT STARTED] mode.

Steps:

1. The Test System commands the AUT to replay the Application User Flow 5.8 Pause and Resume one reference media file upload.

2. The Test System measures whether the pause operation and the resume operation were successful or not.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- File Pause Upload Operation: Whether the pause upload operation is successful or not.

- File Resume Upload Operation: Whether the resume upload operation is successful or not.

4.4.7 Virtual Reality

4.4.7.1 Virtual Experience Loading

Identifier: *REL/VR/001*

Title: Virtual Experience Loading

Objective: Measure the reliability KPIs of the AUT when spinning the device host in the three axis with a virtual experience selected.

Applicability:

(ICSG_ProductType = Application) AND (ICSG_UseCases includes VR)

Initial Conditions:

AUT is in [AUT STARTED] mode.

Steps:

1. The Test System commands the AUT to replay the Application User Flow 6.1 Select a virtual experience.

2. The Test System measures the time to recognize the target object.

3. The Test System spins up the Host Device 30 degrees.

4. The Test System measures the time to recognize the target object.

5. The Test System spins down the Host Device 60 degrees.

6. The Test System measures the time to recognize the target object.

7. The Test System spins up the Host Device 30 degrees and spins left 60 degrees.

8. The Test System measures the time to recognize the target object.

9. The Test System spins right the Host Device 120 degrees.

10. The Test System measures the time to recognize the target object.

11. The Test System spins left 60 degrees.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- Immersion Cut-off: Probability that successfully started immersion is ended by a cause other than the intentional termination by the user.

4.4.7.2 Virtual Scene Loading

Identifier: *REL/VR/002*

Title: Virtual Scene Loading

Objective: Measure the reliability KPIs of the AUT when moving the device host horizontally from the initial observation point under the user control.

Applicability:

(ICSG_ProductType = Application) AND (ICSG_UseCases includes VR)

Initial Conditions:

AUT is in [AUT STARTED] mode.

Steps:

1. The Test System commands the AUT to replay the Application User Flow 6.1 Select a virtual experience.
2. The Test System waits until the target object is recognized.
3. The Test System spins up the Host Device a random number of degrees between 10 and 50.
4. The Test System waits until the target object is recognized.
5. The Test System commands the AUT to move horizontally (walking speed, 4 km/h) during 20 seconds in order to change the scene.
6. The Test System measures the time to recognize the target object.
7. The Test System spins back the Host Device to the original position.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- Time to load the virtual scene: Time elapsed from selecting an scenario (world, experience, etc.) to loading the 3D visual context.

- Immersion Cut-off: Probability that successfully started immersion is ended by a cause other than the intentional termination by the user.

- Video resolution: Used frame resolution.

4.4.8 Augmented Reality

4.4.8.1 Load Augmentation Layer on Physical Marker

Identifier: *REL/AR/001*

Title: Load Augmentation Layer on physical marker

Objective: Measure the reliability KPIs of the AUT when rendering a virtual layer on top of a moving physical marker.

Applicability:

(ICSG_ProductType = Application) AND (ICSG_UseCases includes AR)

Initial Conditions:

AUT is in [AUT STARTED] mode.

Steps:

1. The Test System commands the AUT to replay the Application User Flow 7.1 Load augmentation layer on a physical marker.

2. The Test System forces the Host Device to aim at a physical maker.

3. The Test System measures the time elapsed by the AUT to display a virtual layer on top of the physical marker.

4. The Test System spins (in any direction) the Host Device 30 degrees, while the physical marker remains in the same position.

5. The Test System measures whether the AUT keeps showing the virtual layer on top of the physical virtual or not.

6. The Test System spins back to the original position.

7. The Test System measures whether the AUT keeps showing the virtual layer on top of the physical marker or not.

8. The Test System commands the AUT to exit augmented reality mode.

9. The Test System measures whether the AUT clears up the virtual layer or not.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- Time to load augmentation: Time elapsed from aiming the device at physical marker to displaying the virtual layer on top of it.

- Augmentation Cut-off: Probability that successfully started immersion is ended by a cause other than the intentional termination by the user.

- Clear Augmentation Layer Operation: Whether the clear virtual operation is successful or not.

4.4.8.2 Load Augmentation Layer at Location

Identifier: *REL/AR/002*

Title: Load Augmentation Layer at specific location

Objective: Measure the reliability KPIs of the AUT when rendering a virtual layer at a specific location.

Applicability:

(ICSG_ProductType = Application) AND (ICSG_UseCases includes AR)

Initial Conditions:

AUT is in [AUT STARTED] mode.

Steps:

1. The Test System commands the AUT to replay the Application User Flow 7.2 Load augmentation layer at a specific location.
2. The Test System forces the Host Device to be set at specific position.
3. The Test System measures the time elapsed by the AUT to display a virtual layer at the current location.
4. The Test System commands the AUT to exit augmented reality mode.
5. The Test System measures whether the AUT clears up the virtual layer from the Host Device screen or not.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- Time to load augmentation: Time elapsed from setting the Host Device at a specfic locaiton to displaying the virtual layer.
- Augmentation Cut-off: Probability that successfully started immersion is ended by a cause other than the intentional termination by the user.
- Clear Augmentation Layer Operation: Whether the clear virtual operation is successful or not.

4.4.9 Gaming

4.4.9.1 Start new game sessions

Identifier: *REL/GA/001*

Title: Start new game sessions

Objective: Measure the reliability KPIs of the AUT when starting new game sessions.

Applicability:

(ICSG_ProductType = Application) AND (ICSG_UseCases includes GA)

Initial Conditions:

- AUT is in [AUT STARTED] mode.
- AUT options are configured to their default values.

- Any AUT screen saving option is disabled.

- AUT resolution is configured to maximum resolution available.

- AUT Music and sound effects are configured to be ON.

- No energy saving option is enabled in the AUT.

Steps:

1. The Test System commands the AUT to replay the Application User Flow 10.6: Start two game sessions.

2. The Test System measures the time to successfully start the game session the first time (including connection to server and loading).

3. The Test System measures the time to successfully start the game a second time.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- Time to load the game: The time elapsed since the user clicks play button until the AUT loads the game session and the user can start the interaction with the Host Device for playing.

- Start Game Operation: Whether the game session is successfully loaded or not.

- Time to load the second game: The time elapsed since the user clicks play button until the AUT loads the game session the second time and the user can start the interaction with the Host Device for playing.

- Start Game Operation: Whether the second game session is successfully loaded or not.

4.4.9.2 Long Game session

Identifier: *REL/GA/002*

Title: Long game session

Objective: Measure the reliability KPIs of the AUT when playing a game session.

Applicability:

(ICSG_ProductType = Application) AND (ICSG_UseCases includes GA)

Initial Conditions:

- AUT is in [AUT STARTED] mode.

- AUT options are configured to their default values.

- Any AUT screen saving option is disabled.

- AUT resolution is configured to maximum resolution available.

- AUT Music and sound effects are configured to be ON.

- No energy saving option is enabled in the AUT.

Steps:

1. The Test System commands the AUT to replay the Application User Flow 7.3: Play long gaming session. The application user flow must last at least 5 minutes.

2. The Test System measures the number of times and the duration that the game session stalls and the content resolution.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- Game Cut-off: Probability that successfully started gaming session ends due to a cause other than the intentional termination by the user.

- Game Content Stall: The elapsed duration of content stalling while executing the gaming session.

- Video resolution: Used video resolution.

4.4.9.3 Pause and Resume

Identifier: *REL/GA/003*

Title: Pause and resume

Objective: Measure the reliability KPIs of the AUT when pausing and resuming a game session.

Applicability:

(ICSG_ProductType = Application) AND (ICSG_UseCases includes GA) AND ICSA_GAPause

Initial Conditions:

- AUT is in [AUT STARTED] mode.

- AUT options are configured to their default values.

- Any AUT screen saving option is disabled.

- AUT resolution is configured to maximum resolution available.

- AUT Music and sound effects are configured to be ON.

- No energy saving option is enabled in the AUT.

Steps:

1. The Test System commands the AUT to replay the Application User Flow 10.4: Pause and resume a game session.

2. The Test System measures whether pause operation and the resume operation were successful or not during step1.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- Pause Operation: Whether pause operation is successful or not.

- Resume Operation: Whether resume operation is successful or not.

- Time to load game session after resuming: The time elapsed since the user clicks resume button until the AUT user can resume the interaction with the Host Device for playing.

4.4.9.4 Start saved game session

Identifier: *REL/GA/004*

Title: Start saved game session

Objective: Measure the reliability KPIs of the AUT when starting a saved game session.

Applicability:

(ICSG_ProductType = Application) AND (ICSG_UseCases includes GA) AND ICSA_GASaveGame

Initial Conditions:

- AUT is in [AUT STARTED] mode.
- AUT options are configured to their default values.
- Any AUT screen saving option is disabled.
- AUT resolution is configured to maximum resolution available.
- AUT Music and sound effects are configured to be ON.
- No energy saving option is enabled in the AUT.

Steps:

1. The Test System commands the AUT to replay the Application User Flow 10.5: Saved game session.
2. The Test System measures the time to successfully start the game when starting the saved game version (including connection to server and loading).

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- Time to load the game: The time elapsed since the user clicks play button until the AUT loads the saved game session and the user can start the interaction with the Host Device for playing.
- Start Game Operation: Whether the saved game session is successfully loaded or not.

4.5 Network Resources Usage (NWR)

4.5.1 Common Services

The tests cases in this section apply to all Use Cases.

4.5.1.1 Device ON

Identifier: NWR*/CO/001*

Title: Device ON

Objective: Measure the use of network resources that are consumed by the Host Device when the AUT is not running.

Applicability:

(ICSG_ProductType = Application)

Initial Conditions:

AUT is in [AUT NOT RUNNING] mode.

Steps:

1. The Test System measures the use of network resources during 20 minutes with the AUT not running and the device switched on.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- DL IP data usage: Total number of bytes transferred in the DL during the measurement time.

- UL IP data usage: Total number of bytes transferred in the UL during the measurement time.

4.5.1.2 Open the app

Identifier: NWR*/CO/002*

Title: Login and log out

Objective: Measure the AUT consumption of network resources when it is started, and logged in, and then closed and started again.

Applicability:

(ICSG_ProductType = Application) AND ICSA_Login

Initial Conditions:

AUT is in [AUT NOT RUNNING] mode.

Steps:

1. The Test System commands the AUT to replay the Application User Flow 1.1: Reopen the App.

2. The Test System measures the use of network resources from initiating the App to closing and reopening it again.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- DL IP data usage: Total number of bytes transferred in the DL during the measurement time.

- UL IP data usage: Total number of bytes transferred in the UL during the measurement time.

4.5.1.3 Background state

Identifier: NWR*/CO/003*

Title: Background state

Objective Measure the AUT consumption of network resources when it is in background state.

Applicability:

(ICSG_ProductType = Application)

Initial Conditions:

AUT is in [AUT STARTED] mode.

Steps:

1. The Test System commands the AUT to replay the Application User Flow 1.1: Reopen the App.

2. The Test Systems sets the AUT in background state.

3. The Test System measures the use of network resources during 20 minutes with the AUT in background state.

4. The Test Systems sets the AUT back in active state.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- DL IP data usage: Total number of bytes transferred in the DL during the measurement time.

- UL IP data usage: Total number of bytes transferred in the UL during the measurement time.

4.5.2 CS Content Distribution Streaming Services

Note: The following test cases are defined to prevent any device-side content caching which the AUT could implement. However, if the AUT Backend Service also implements a server-side caching (e.g., storing the current playback time for a user), preventing that effect is left to the implementation of the test case.

4.5.2.1 Non Interactive Playback

Identifier: NWR*/CS/001*

Title: Non Interactive Playback

Objective: Measure the AUT consumption of network resources while executing the feature media file playing from the Content Distribution Streaming Services use case.

Applicability:

(ICSG_ProductType = Application) AND (ICSG_UseCases includes CS) AND ICSA_CSPlay

Initial Conditions:

AUT is in [AUT STARTED] mode.

Steps:

1. The Test System commands the AUT to replay the Application User Flow 2.1: Play three reference media files.

2. The Test System measures the bytes transferred while playing the reference files.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- DL IP data usage: Total number of bytes transferred in the DL during the transmission of the reference media files.

- UL IP data usage Total number of bytes transferred in the UL during the transmission of the reference media files.

4.5.2.2 Play and Pause

Identifier: NWR*/CS/002*

Title: Play and Pause

Objective: Measure the AUT consumption of network resources when a media file is in pause mode.

Applicability:

(ICSG_ProductType = Application) AND (ICSG_UseCases includes CS) AND ICSA_CSPause

Initial Conditions:

AUT is in [AUT STARTED] mode.

Steps:

1. The Test System commands the AUT to replay the Application User Flow 2.2: Play and pause.

2. The Test System measures the bytes transferred during the period the reference video is in Pause mode.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- DL IP data usage: Total number of bytes transferred in the DL during the measurement time.

- UL IP data usage: Total number of bytes transferred in the UL during the measurement time.

4.5.2.3 Rewind

Identifier: NWR*/CS/003*

Title: Rewind

Objective: Measure the AUT consumption of network resources when performing rewind operation while playing a media file.

Applicability:

(ICSG_ProductType = Application) AND (ICSG_UseCases includes CS) AND ICSA_CSRewind

Initial Conditions:

AUT is in [AUT STARTED] mode.

Steps:

1. The Test System commands the AUT to replay the Application User Flow 2.9: Rewind.
2. The Test System measures the bytes transferred during the rewind operation.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- DL IP data usage: Total number of bytes transferred in the DL during the measurement time.
- UL IP data usage: Total number of bytes transferred in the UL during the measurement time.

4.5.2.4 Download content for offline playing

Identifier: NWR*/CS/004*

Title: Download content for offline playing

Objective: Measure the network resources consumed by an AUT when downloading a media file for offline playing.

Applicability:

(ICSG_ProductType = Application) AND (ICSG_UseCases includes CS) AND ICSA_CSDownloadMedia

Initial Conditions:

AUT is in [AUT STARTED] mode.

Steps:

1. The Test System commands the AUT to replay the Application User Flow 2.4: Download a media file.

2. The Test System measures the bytes transferred during the period the media file is being downloaded.

3. The Test System commands the AUT to delete the media file.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- DL IP data usage: Total number of bytes transferred in the DL during the measurement time.

- UL IP data usage: Total number of bytes transferred in the UL during the measurement time.

4.5.2.5 Fast Forward

Identifier: NWR*/CS/005*

Title: Fast Forward

Objective: Measure the network resources consumed by an AUT when performing fast forward operation while playing a media file.

Applicability:

(ICSG_ProductType = Application) AND (ICSG_UseCases includes CS) AND ICSA_CSFastForward

Initial Conditions:

AUT is in [AUT STARTED] mode.

Steps:

1. The Test System commands the AUT to replay the Application User Flow 2.10: Fast Forward.

2. The Test System measures the bytes transferred during the fast forward operation.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- DL IP data usage: Total number of bytes transferred in the DL during the measurement time.

- UL IP data usage: Total number of bytes transferred in the UL during the measurement time.

4.5.3 Live Streaming Services

4.5.3.1 Play Live Video from User

Identifier: NWR*/LS/001*

Title: Play Live Video from User

Objective: Measure the AUT consumption of network resources while executing the feature live video playing from the Live Streaming Services use case.

Applicability:

(ICSG_ProductType = Application) AND (ICSG_UseCases includes LS)

Initial Conditions:

- AUT is in [AUT STARTED] mode.

- An Internet connected PC transmits live video as defined in section 2.6.1.

Steps:

1. The Test System commands the AUT to replay the Application User Flow 3.1: Playing live video from a known user.

2. The Test System measures the bytes transferred during the video play operation.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- DL IP data usage: Total number of bytes transferred in the DL during the measurement time.

- UL IP data usage: Total number of bytes transferred in the UL during the measurement time.

4.5.3.2 Broadcast Live Video

Identifier: NWR*/LS/002*

Title: Broadcast Live Video to User

Objective: Measure the AUT consumption of network resources when broadcasting live content.

Applicability:

(ICSG_ProductType = Application) AND (ICSG_UseCases includes LS)

Initial Conditions:

- AUT is in [AUT STARTED] mode.

- The Host Device camera is focused on a TV displaying reference video RTVP2.

Steps:

1. The Test Systems starts playing RTVP2 on the TV.

2. The Test System commands the AUT to replay the Application User Flow 3.2: Broadcast live video.

3. The Test System measures the bytes transferred during the live video broadcast operation.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- DL IP data usage: Total number of bytes transferred in the DL during the measurement time.

- UL IP data usage: Total number of bytes transferred in the UL during the measurement time.

4.5.4 Social Networking

4.5.4.1 Picture Posting

Identifier: NWR*/SN/001*

Title: Picture Posting

Objective: Measure the AUT consumption of network resources while executing the feature picture uploading in the Social Networking use case.

Applicability:

(ICSG_ProductType = Application) AND (ICSG_UseCases includes SN) AND ICSA_SNPostImage

Initial Conditions:

AUT is in [AUT STARTED] mode.

Steps:

1. The Test System commands the AUT to replay the Application User Flow 4.2: Uploading three reference pictures separately.

2. The Test System measures the bytes transferred during the pictures uploading operation.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- DL IP data usage: Total number of bytes transferred in the DL during the measurement time.

- UL IP data usage: Total number of bytes transferred in the UL during the measurement time.

4.5.4.2 Video Posting

Identifier: NWR*/SN/002*

Title: Video Posting

Objective: Measure the AUT consumption of network resources while executing the feature video uploading in the Social Networking use case.

Applicability:

(ICSG_ProductType = Application) AND (ICSG_UseCases includes SN) AND ICSA_SNPostVideo

Initial Conditions:

AUT is in [AUT STARTED] mode.

Steps:

1. The Test System commands the AUT to replay the Application User Flow 4.3: Post videos sequentially.

2. The Test System measures the bytes transferred during the videos uploading operation.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- DL IP data usage: Total number of bytes transferred in the DL during the measurement time.

- UL IP data usage: Total number of bytes transferred in the UL during the measurement time.

4.5.4.3 Comment Posting

Identifier: NWR*/SN/003*

Title: Comment Uploading

Objective: Measure the AUT consumption of network resources while executing the feature comment uploading in the Social Networking use case.

Applicability:

(ICSG_ProductType = Application) AND (ICSG_UseCases includes SN) AND ICSA_SNPostComment

Initial Conditions:

AUT is in [AUT STARTED] mode.

Steps:

1. The Test System commands the AUT to replay the Application User Flow 4:1: Uploading three reference comments separately.

2. The Test System measures the bytes transferred during the comments uploading operation.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- DL IP data usage: Total number of bytes transferred in the DL during the measurement time.

- UL IP data usage: Total number of bytes transferred in the UL during the measurement time.

4.5.4.4 File Posting

Identifier: NWR*/SN/004*

Title: File Uploading

Objective: Measure the AUT consumption of network resources while executing the feature file posting in the Social Networking use case.

Applicability:

(ICSG_ProductType = Application) AND (ICSG_UseCases includes SN) AND ICSA_SNPostFile.

Initial Conditions:

AUT is in [AUT STARTED] mode.

Steps:

1. The Test System commands the AUT to replay the Application User Flow 4.6: Post three reference files separately.

2. The Test System measures the bytes transferred during the files uploading operation.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- DL IP data usage: Total number of bytes transferred in the DL during the measurement time.

- UL IP data usage: Total number of bytes transferred in the UL during the measurement time.

4.5.4.5 Show Picture

Identifier: NWR*/SN/005*

Title: Show picture

Objective: Measure the AUT consumption of network resources while executing the feature show picture in the Social Networking use case.

Applicability:

(ICSG_ProductType = Application) AND (ICSG_UseCases includes SN) AND ICSA_SNGetImage

Initial Conditions:

AUT is in [AUT STARTED] mode.

Steps:

1. The Test System commands the AUT to replay the Application User Flow 4.8: Show three reference pictures.

2. The Test System measures the bytes transferred during the pictures downloading operation.

Postamble:

*   Execute the Postamble sequence (see section 2.5).

Measurements:

*   DL IP data usage: Total number of bytes transferred in the DL during the measurement time.

*   UL IP data usage: Total number of bytes transferred in the UL during the measurement time.

4.5.4.6 Play Video

Identifier: NWR*/SN/006*

Title: Play Video

Objective: Measure the AUT consumption of network resources while executing the feature play video in the Social Networking use case.

Applicability:

(ICSG_ProductType = Application) AND (ICSG_UseCases includes SN) AND ICSA_SNGetVideo

Initial Conditions:

AUT is in [AUT STARTED] mode.

Steps:

1. The Test System commands the AUT to replay the Application User Flow 4.9 Play three reference videos.

2. The Test System measures the bytes transferred during the videos playing operation.

Postamble:

*   Execute the Postamble sequence (see section 2.5).

Measurements:

*   DL IP data usage: Total number of bytes transferred in the DL during the measurement time.

*   UL IP data usage: Total number of bytes transferred in the UL during the measurement time.

4.5.4.7 File Downloading

Identifier: NWR*/SN/007*

Title: File Downloading

Objective: Measure the AUT consumption of network resources while executing the feature file downloading in the Social Networking use case.

Applicability:

(ICSG_ProductType = Application) AND (ICSG_UseCases includes SN) AND ICSA_SNGetFile

Initial Conditions:

AUT is in [AUT STARTED] mode.

Steps:

1. The Test System commands the AUT to replay the Application User Flow 4.12: Downloading three reference flies.

2. The Test System measures the bytes transferred during the files downloading operation.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- DL IP data usage: Total number of bytes transferred in the DL during the measurement time.

- UL IP data usage: Total number of bytes transferred in the UL during the measurement time.

4.5.4.8 Play Live Video from User

Identifier: NWR/SN/008

Title: Play Live Video from User

Objective: Measure the AUT consumption of network resources while playing a live video from a user.

Applicability:

(ICSG_ProductType = Application) AND (ICSG_UseCases includes SN)

Initial Conditions:

AUT is in [AUT STARTED] mode.

Steps:

1. The Test System commands the AUT to replay the Application User Flow 4.10: Play live video from a user.

2. The Test System measures the bytes transferred during the video playing operation.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- DL IP data usage: Total number of bytes transferred in the DL during the measurement time.

- UL IP data usage: Total number of bytes transferred in the UL during the measurement time.

4.5.4.9 Search Object

Identifier: NWR*/SN/009*

Title: Search Object

Objective: Measure the AUT consumption of network resources while searching the most relevant item for which the AUT has been mainly designed (e.g., contacts, flights, hotels, etc.).

Applicability:

(ICSG_ProductType = Application) AND (ICSG_UseCases includes SN)

Initial Conditions:

AUT is in [AUT STARTED] mode.

Steps:

1. The Test System commands the AUT to replay the Application User Flow 4.13: Search object.

2. The Test System measures the bytes transferred during the searching operation.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- DL IP data usage: Total number of bytes transferred in the DL during the measurement time.

- UL IP data usage: Total number of bytes transferred in the UL during the measurement time.

4.5.5 High Speed Internet

4.5.5.1 Downloading files sequentially

Identifier: NWR*/HS/001*

Title: Downloading files sequentially

Objective: Measure the AUT consumption of network resources while executing the feature file downloading in the High Speed Internet use case.

Applicability:

(ICSG_ProductType = Application) AND (ICSG_UseCases includes HS)

Initial Conditions:

AUT is in [AUT STARTED] mode.

Steps:

1. The Test System commands the AUT to replay the Application User Flow 5.1: Download three reference flies.

2. The Test System measures the bytes transferred during the files downloading operation.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- DL IP data usage: Total number of bytes transferred in the DL during the measurement time.

- UL IP data usage: Total number of bytes transferred in the UL during the measurement time.

4.5.5.2 Uploading files sequentially

Identifier: NWR/*HS/002*

Title: Uploading files sequentially

Objective: Measure the AUT consumption of network resources while executing the feature file uploading in the High Speed Internet use case.

Applicability:

(ICSG_ProductType = Application) AND (ICSG_UseCases includes HS)

Initial Conditions:

AUT is in [AUT STARTED] mode.

Steps:

1. The Test System commands the AUT to replay the Application User Flow 5.2: Upload three reference flies.

2. The Test System measures the bytes transferred during the files uploading operation.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- DL IP data usage: Total number of bytes transferred in the DL during the measurement time.

- UL IP data usage: Total number of bytes transferred in the UL during the measurement time.

4.5.5.3 Pause and Resume Download Transfer

Identifier: NWR/*HS/003*

Title: Pause and Resume Download Transfer

Objective: Measure the AUT consumption of network resources when pausing and resuming a file download.

Applicability:

(ICSG_ProductType = Application) AND (ICSG_UseCases includes HS)

Initial Conditions:

AUT is in [AUT STARTED] mode.

Steps:

1. The Test System commands the AUT to replay the Application User Flow 5.7 Pause and Resume one reference media file download.

2. The Test System measures the bytes transferred between the file-downloading pausing and resuming operations.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- DL IP data usage: Total number of bytes transferred in the DL during the measurement time.

- UL IP data usage: Total number of bytes transferred in the UL during the measurement time.

4.5.5.4 Pause and Resume Upload Transfer

Identifier: NWR*/HS/004*

Title: Pause and Resume Upload Transfer

Objective: Measure the AUT consumption of network resources when pausing and resuming a file upload.

Applicability:

(ICSG_ProductType = Application) AND (ICSG_UseCases includes HS)

Initial Conditions:

AUT is in [AUT STARTED] mode.

Steps:

1. The Test System commands the AUT to replay the Application User Flow 5.8 Pause and Resume one reference media file upload.

2. The Test System measures the bytes transferred between the file-uploading pausing and resuming operations.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- DL IP data usage: Total number of bytes transferred in the DL during the measurement time.

- UL IP data usage: Total number of bytes transferred in the UL during the measurement time.

4.5.6 Virtual Reality

4.5.6.1 Virtual Experience Loading

Identifier: NWR*/VR/001*

Title: Virtual Experience Loading

Objective: Measure the AUT consumption of network resources when looking around with three degrees of movement freedom from a single observation point.

Applicability:

(ICSG_ProductType = Application) AND (ICSG_UseCases includes VR)

Initial Conditions:

AUT is in [AUT STARTED] mode.

Steps:

1. The Test System commands the AUT to replay the Application User Flow 6.1 Select a virtual experience.

2. The Test System waits until the target object is recognized.

3. The Test System spins up the Host Device 30 degrees.

4. The Test System waits until the target object is recognized.

5. The Test System spins down the Host Device 60 degrees.

6. The Test System waits until the target object is recognized.

7. The Test System spins up the Host Device 30 degrees and spins left 60 degrees.

8. The Test System waits until the target object is recognized.

9. The Test System spins right the Host Device 120 degrees.

10. The Test System waits until the target object is recognized.

11. The Test System spins left 60 degrees.

12. The Test System measures the bytes transferred during the execution of step 1 to step 11.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- DL IP data usage: Total number of bytes transferred in the DL during the measurement time.

- UL IP data usage: Total number of bytes transferred in the UL during the measurement time.

4.5.6.2 Virtual Scene Loading

Identifier: NWR*/VR/002*

Title: Virtual Scene Loading

Objective: Measure the AUT consumption of network resources when moving horizontally from the initial observation point under the user control.

Applicability:

(ICSG_ProductType = Application) AND (ICSG_UseCases includes VR)

Initial Conditions:

AUT is in [AUT STARTED] mode.

Steps:

1. The Test System commands the AUT to replay the Application User Flow 6.1 Select a virtual experience.
2. The Test System waits until the target object is recognized.
3. The Test System spins up the Host Device a random number of degrees between 10 and 50.
4. The Test System waits until the target object is recognized.
5. The Test System commands the AUT to move horizontally (walking speed, 4 km/h) during 20 seconds in order to change the scene.
6. The Test System waits until the target object is recognized.
7. The Test System spins back the Host Device to the original position.
8. The Test System measures the bytes transferred during the execution of step 1 to step 6.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- DL IP data usage: Total number of bytes transferred in the DL during the measurement time.
- UL IP data usage: Total number of bytes transferred in the UL during the measurement time.

4.5.7 Augmented Reality

4.5.7.1 Load Augmentation Layer on Physical Marker

Identifier: NWR*/AR/001*

Title: Load Augmentation Layer on physical marker

Objective: Measure the AUT consumption of network resources when rendering a virtual layer on top of a moving physical marker.

Applicability:

(ICSG_ProductType = Application) AND (ICSG_UseCases includes AR)

Initial Conditions:

AUT is in [AUT STARTED] mode.

Steps:

1. The Test System commands the AUT to replay the Application User Flow 7.1 Load augmentation layer on a physical marker.
2. The Test System forces the Host Device to aim at a physical maker.
3. The Test System waits until the AUT displays a virtual layer on top of the physical marker.
4. The Test System spins (in any direction) the Host Device 30 degrees, while the physical marker remains in the same position and waits for five seconds.
5. The Test System spins back to the original position and waits for five seconds.
6. The Test System commands the AUT to exit augmented reality mode.
7. The Test System measures the bytes transferred during the execution of step 1 to step 5.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- DL IP data usage: Total number of bytes transferred in the DL during the measurement time.
- UL IP data usage: Total number of bytes transferred in the UL during the measurement time.

4.5.7.2 Load Augmentation Layer at Location

Identifier: NWR*/AR/002*

Title: Load Augmentation Layer at specific location

Objective: Measure the AUT consumption of network resources when rendering a virtual layer at a specific location.

Applicability:

(ICSG_ProductType = Application) AND (ICSG_UseCases includes AR)

Initial Conditions:

AUT is in [AUT STARTED] mode.

Steps:

1. The Test System commands the AUT to replay the Application User Flow 7.2 Load augmentation layer at a specific location.

2. The Test System forces the Host Device to be set at specific position.

3. The Test System waits until the AUT displays a virtual layer at the current location.

4. The Test System commands the AUT to exit augmented reality mode.

5. The Test System measures the bytes transferred during the execution of step 1 to step 3.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- DL IP data usage: Total number of bytes transferred in the DL during the measurement time.

- UL IP data usage: Total number of bytes transferred in the UL during the measurement time.

4.5.8   Gaming

4.5.8.1 Start new game sessions

Identifier: NWR*/GA/001*

Title: Start new game sessions

Objective: Measure the AUT consumption of network resources when starting new game sessions.

Applicability:

(ICSG_ProductType = Application) AND (ICSG_UseCases includes GA)

Initial Conditions:

- AUT is in [AUT STARTED] mode.

- AUT options are configured to their default values.

- Any AUT screen saving option is disabled.

- AUT resolution is configured to maximum resolution available.

- AUT Music and sound effects are configured to be ON.

- No energy saving option is enabled in the AUT.

Steps:

1. The Test System commands the AUT to replay the Application User Flow 10.6: Start two game sessions.

2. The Test System measures the time to successfully start the game session the first time (including connection to server and loading).

3. The Test System measures the time to successfully start the game a second time.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- DL IP data usage: Total number of bytes transferred in the DL during the measurement time.

- UL IP data usage: Total number of bytes transferred in the UL during the measurement time.

4.5.8.2 Long Game session

Identifier: NWR*/GA/002*

Title: Long game session

Objective: Measure the AUT consumption of network resources when playing a game session.

Applicability:

(ICSG_ProductType = Application) AND (ICSG_UseCases includes GA)

Initial Conditions:

- AUT is in [AUT STARTED] mode.

- AUT options are configured to their default values.

- Any AUT screen saving option is disabled.

- AUT resolution is configured to maximum resolution available.

- AUT Music and sound effects are configured to be ON.

- No energy saving option is enabled in the AUT.

Steps:

1. The Test System commands the AUT to replay the Application User Flow 7.3: Play long gaming session. The application user flow must last at least 5 minutes.

2. The Test System measures the number of times and the duration that the game session stalls and the content resolution.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- DL IP data usage: Total number of bytes transferred in the DL during the measurement time.

- UL IP data usage: Total number of bytes transferred in the UL during the measurement time.

4.5.8.3 Pause and Resume

Identifier: *NWR/GA/003*

Title: Pause and resume

Objective: Measure the AUT consumption of network resources when pausing and the resuming a game session.

Applicability:

(ICSG_ProductType = Application) AND (ICSG_UseCases includes GA) AND ICSA_GAPause

Initial Conditions:

- AUT is in [AUT STARTED] mode.

- AUT options are configured to their default values.

- Any AUT screen saving option is disabled.

- AUT resolution is configured to maximum resolution available.

- AUT Music and sound effects are configured to be ON.

- No energy saving option is enabled in the AUT.

Steps:

1. The Test System commands the AUT to replay the Application User Flow 10.4: Pause and resume a game session.

2. The Test System measures whether pause operation and the resume operation were successful or not during step1.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- DL IP data usage: Total number of bytes transferred in the DL during the measurement time.

- UL IP data usage: Total number of bytes transferred in the UL during the measurement time.

4.5.8.4 Start saved game session

Identifier: *NWR/GA/004*

Title: Start saved game session

Objective: Measure the AUT consumption of network resources when starting a saved game session.

Applicability:

(ICSG_ProductType = Application) AND (ICSG_UseCases includes GA) AND ICSA_GASaveGame

Initial Conditions:

- AUT is in [AUT STARTED] mode.

- AUT options are configured to their default values.

- Any AUT screen saving option is disabled.

- AUT resolution is configured to maximum resolution available.

- AUT Music and sound effects are configured to be ON.

- No energy saving option is enabled in the AUT.

Steps:

1. The Test System commands the AUT to replay the Application User Flow 10.5: Saved game session.

2. The Test System measures the time to successfully start the game when starting the saved game version (including connection to server and loading).

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- DL IP data usage: Total number of bytes transferred in the DL during the measurement time.

- UL IP data usage: Total number of bytes transferred in the UL during the measurement time.

5   Mobile devices Test cases

5.1   Mobile devices User Experience with Reference Apps (DRA)

5.1.1   CS Content Distribution Streaming Services

5.1.1.1 Non Interactive Playback

Identifier: *DRA/CS/001*

Title: Non Interactive Playback

Objective: Measure the user experience KPIs of the CSRA when running on the DUT while executing the feature media file playing from the Content Distribution Streaming Services use case.

Applicability:

ICSG_ProductType = Mobile device

Initial Conditions:

- The DUT is in [DUT-READY] mode.

Steps:

1. The Test System calls the Reference App API to execute the action 2.1: Play three reference media files.
2. The Test System measures the initial buffering, the number and duration of re-buffering occurrences and the video resolution.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- Time to load first media frame: The time elapsed since the user clicks play button until the media reproduction starts.

- Playback Cut-off: Probability that successfully started stream reproduction is ended by a cause other than the intentional termination by the user.

- Content Stall (s): The elapsed duration of content stalls while playing the content.

- Video resolution: Used video resolution.

5.1.1.2 Play and Pause

Identifier: *DRA/CS/002*

Title: Play and Pause

Objective: Measure the ability of the CSRA when running on the DUT to pause and the resume a media file.

Applicability:

(ICSG_ProductType = Mobile device) AND ICSD_PlayVideo

Initial Conditions:

- The DUT is in [DUT-READY] mode.

Steps:

1. The Test System calls the Reference App API to execute the action 2.2: Play and Pause.

2. The Test System measures whether pause operation was successful or not.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- Playback Cut-off: Probability that successfully started stream reproduction is ended by a cause other than the intentional termination by the user.

- Pause Operation: Whether pause operation is successful or not.

- Time to load first media frame (s) after resuming: The time elapsed since the user clicks resume button until the media reproduction starts.

5.1.1.3 Stop and Replay

Identifier: *DRA/CS/003*

Title: Stop and Replay

Objective: Measure the ability the CSRA when running on the DUT to stop and the re-play a media file.

Applicability:

(ICSG_ProductType = Mobile device) AND ICSD_PlayVideo

Initial Conditions:

- The DUT is in [DUT-READY] mode.

Steps:

1. The Test System calls the Reference App API to execute the action 2.6: Stop and Replay.

2. The Test System measures whether stop re-play operations were successful or not.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- Time to load first media frame: The time elapsed since the user clicks play button until the media reproduction starts.

- Playback Cut-off**:** Probability that successfully started stream reproduction is ended by a cause other than the intentional termination by the user.

- Stop Operation: Whether stop operation is successful or not.

5.1.1.4 Search and Seek

Identifier: *DRA/CS/004*

Title: Media file Seek

Objective: Measure the ability the CSRA when running on the DUT to search a media file and seek at any time in the media file.

Applicability:

(ICSG_ProductType = Mobile device) AND ICSD_PlayVideo

Initial Conditions:

- The DUT is in [DUT-READY] mode.

Steps:

1. The Test System calls the Reference App API to execute the action 2.7: Search and Seek.

2. The Test System measures the search time and the time to load the first media frame after the seek operation.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- Search Time: The time elapsed since the user clicks search button until the first search result is shown.

- Playback Cut-off: Probability that successfully started stream reproduction is ended by a cause other than the intentional termination by the user.

- Time to load first frame: The time elapsed since the user clicks play button until reproduction resumes after seek operation.

5.1.1.5 Rewind

Identifier: *DRA/CS/005*

Title: Rewind

Objective: Measure the ability the CSRA when running on the DUT to perform rewind operation while playing a media file.

Applicability:

(ICSG_ProductType = Mobile device) AND ICSD_PlayVideo

Initial Conditions:

- The DUT is in [DUT-READY] mode.

Steps:

1. The Test System calls the Reference App API to execute the action 2.9: Rewind.

2. The Test System measures the time to load the first media frame after the rewind operation.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- Playback cut-off: Probability that successfully started stream reproduction is ended by a cause other than the intentional termination by the user.

- Time to load first media frame: The average of the time elapsed since the user clicks play button until reproduction resumes after rewind operation.

- Rewind operation: Whether rewind operation is successful or not.

5.1.1.6 Playlist Skip Forward and Backward

Identifier: *DRA/CS/006*

Title: Playlist Skip Forward and Backward

Objective: Measure the ability the CSRA when running on the DUT to skip forward and backward through a playlist while playing a media file.

Applicability:

(ICSG_ProductType = Mobile device) AND ICSD_PlayVideo

Initial Conditions:

- The DUT is in [DUT-READY] mode.

Steps:

1. The Test System calls the Reference App API to execute the action 2.8: Skip Forward and Backward.
2. The Test System measures the time to load the first media frame after the first skip backward operation.
3. The Test System measures the time to load the first media frame after the first skip forward operation.
4. The Test System measures the time to load the first media frame after the second skip backward operation.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- Video Playback cut-off: Probability that successfully started stream reproduction is ended by a cause other than the intentional termination by the user.

- Time to load first media frame: The time elapsed since the user clicks play button until reproduction resumes after rewind and fast forward operations.

5.1.1.7 Download content for offline playing

Identifier: *DRA/CS/007*

Title: Download content for offline playing

Objective: Measure the ability the CSRA when running on the DUT to download a media file for offline playing.

Applicability:

ICSG_ProductType = Mobile device

Initial Conditions:

- The DUT is in [DUT-READY] mode.

Steps:

1. The Test System calls the Reference App API to execute the action 2.4: Download a media file.

2. The Test System measures the time to download load the media file.

3. The Test System commands the CSRA to delete the media file.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- Media Download Operation: Whether the download operation is successful or not.

- File Downloading Time: The time elapsed since the user clicks download button until the media reproduction is ready to be started.

5.1.1.8 Fast Forward

Identifier: *DRA/CS/008*

Title: Fast Forward

Objective: Measure the ability the CSRA when running on the DUT to perform fast forward operation while playing a media file.

Applicability:

(ICSG_ProductType = Mobile device) AND ICSD_PlayVideo

Initial Conditions:

- The DUT is in [DUT-READY] mode.

Steps:

1. The Test System calls the Reference App API to execute the action 2.10: Fast Forward.

2. The Test System measures the time to load the first media frame after the fast forward operation.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- Playback cut-off: Probability that successfully started stream reproduction is ended by a cause other than the intentional termination by the user.

- Time to load first media frame: The average of the time elapsed since the user clicks play button until reproduction resumes after fast forward operation.

- Fast forward operation: Whether fast forward operation is successful or not.

5.1.2 Live Streaming Services

5.1.2.1 Play Live Video from User

Identifier: *DRA/LS/001*

Title: Play Live Video from User

Objective: Measure the user experience KPIs of the LSRA when running on the DUT while executing the feature live video playing from the Live Streaming Services use case.

Applicability:

(ICSG_ProductType = Mobile device) AND ICSD_PlayVideo

Initial Conditions:

- The DUT is in [DUT-READY] mode.

- An Internet connected PC transmits live video as defined in section 2.6.1.

Steps:

1. The Test System calls the Reference App API to execute the action 3.1: Playing live video from a known user.

2. The Test System measures the initial buffer, the number of stall occurrences and the video resolution.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- Time to load first picture**:** The time elapsed since the user clicks play button until the LSRA starts playing the selected broadcast source.

- Broadcasting Reproduction Cut-off**:** Probability that successfully started broadcast reproduction is ended by a cause other than the intentional termination by the LSRA user.

- Content Stall (s): The elapsed duration of content stalls while playing the selected broadcast source.

- Video resolution: Used video resolution.

5.1.2.2 Broadcast Live Video

Identifier: *DRA/LS/002*

Title: Broadcast Live Video to User

Objective: Measure the user experience KPIs of the LSRA when running on the DUT while executing the feature broadcasting live video from the Live Streaming Services use case.

Applicability:

(ICSG_ProductType = Mobile device) AND ICSD_RecordVideo

Initial Conditions:

- The DUT is in [DUT-READY] mode.

- The DUT camera is focused on the fixed TV pattern RTVP1.

Steps:

1. The Test System calls the Reference App API to execute the action 3.2: Broadcast live video.

2. The Test System receives the broadcasted video from the LSRA and measures the number of stall occurrences and the video resolution.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- Time to load receive first picture**:** The time elapsed since the user clicks broadcast button until the Test System starts playing the LSRA broadcast video.

- Broadcasting Reproduction Cut-off**:** Probability that successfully started broadcast reproduction is ended by a cause other than the intentional termination by the LSRA user.

- Content Stall (s): The elapsed duration of content stalls while broadcasting the content.

- Video resolution: Used video resolution.

5.1.3 Social Networking

5.1.3.1 Picture Posting

Identifier: *DRA/SN/001*

Title: Picture Posting

Objective: Measure the user experience KPIs of the SNRA when running on the DUT while executing the feature picture uploading in the Social Networking use case.

Applicability:

ICSG_ProductType = Mobile device

Initial Conditions:

- The DUT is in [DUT-READY] mode.

Steps:

1. The Test System calls the Reference App API to execute the action 4.2: Uploading three reference pictures separately.

2. The Test System measures the time to successfully upload each of the pictures, and whether each upload was successful or not.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- Picture Upload Operation: Whether the upload operation is successful or not.

- Picture Upload Time: The time elapsed since the user clicks upload button until the picture is stored in the SNRA Backend Service.

5.1.3.2 Video Posting

Identifier: *DRA/SN/002*

Title: Video Posting

Objective: Measure the user experience KPIs of the SNRA when running on the DUT while executing the feature video uploading in the Social Networking use case.

Applicability:

ICSG_ProductType = Mobile device

Initial Conditions:

- The DUT is in [DUT-READY] mode.

Steps:

1. The Test System calls the Reference App API to execute the action 4.3: Post videos sequentially.

2. The Test System measures the time to successfully upload each of the video clips, and whether each upload was successful or not.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- Video Upload Operation: Whether the upload operation is successful or not.

- Video Upload Time: The time elapsed since the user clicks upload button until the video clip is stored in the SNRA Backend Service.

5.1.3.3 Comment Posting

Identifier: *DRA/SN/003*

Title: Comment Uploading

Objective: Measure the user experience KPIs of the SNRA when running on the DUT while executing the feature comment uploading in the Social Networking use case.

Applicability:

ICSG_ProductType = Mobile device

Initial Conditions:

- The DUT is in [DUT-READY] mode.

Steps:

1. The Test System calls the Reference App API to execute the action 4:1: Post three reference comments separately.

2. The Test System measures the time to successfully upload each of the comment, and whether each post was successful or not.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- Comment Upload Operation: Whether the upload operation is successful or not.

- Comment Upload Time: The time elapsed since the user clicks upload button until the comment is stored in the SNRA Backend Service.

5.1.3.4 File Posting

Identifier: *DRA/SN/004*

Title: File Uploading

Objective: Measure the user experience KPIs of the SNRA when running on the DUT while executing the feature file posting in the Social Networking use case.

Applicability:

ICSG_ProductType = Mobile device

Initial Conditions:

- The DUT is in [DUT-READY] mode.

Steps:

1. The Test System calls the Reference App API to execute the action 4.6: Post three reference files separately.

2. The Test System measures the time to successfully upload each of the files, and whether each upload was successful or not.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- File Upload Operation: Whether the upload operation is successful or not.

- File Upload Time: The time elapsed since the user clicks upload button until the file is stored in the SNRA Backend Service.

5.1.3.5 Show Picture

Identifier: *DRA/SN/005*

Title: Show picture

Objective: Measure the user experience KPIs of the SNRA when running on the DUT while executing the feature show picture in the Social Networking use case.

Applicability:

ICSG_ProductType = Mobile device

Initial Conditions:

- The DUT is in [DUT-READY] mode.

Steps:

1. The Test System calls the Reference App API to execute the action 4.8: Show three reference pictures.
2. The Test System measures the time to successfully download and show each of the pictures, and whether each download was successful or not.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- Show Picture Operation: Whether the download operation is successful or not.
- Show Picture Time: The time elapsed since the user clicks download button until the picture is shown.

5.1.3.6 Play Video

Identifier: *DRA/SN/006*

Title: Play Video

Objective: Measure the user experience KPIs of the SNRA when running on the DUT while executing the feature play video in the Social Networking use case.

Applicability:

(ICSG_ProductType = Mobile device) AND ICSD_PlayVideo

Initial Conditions:

- The DUT is in [DUT-READY] mode.

Steps:

1. The Test System calls the Reference App API to execute the action 4.9 Play three reference videos.
2. The Test System measures the initial buffer, the number of re-buffering and the content resolution.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- Time to load first media frame: The time elapsed since the user clicks play button until the media reproduction starts.

- Playback Cut-off Ratio: Probability that successfully started stream reproduction is ended by a cause other than the intentional termination by the user.

- Content Stalling: The elapsed duration of content stalling while playing the content.

- Video resolution: Used video resolution.

5.1.3.7 File Downloading

Identifier: *DRA/SN/007*

Title: File Downloading

Objective: Measure the user experience KPIs of the SNRA when running on the DUT while executing the feature file downloading in the Social Networking use case.

Applicability:

ICSG_ProductType = Mobile device

Initial Conditions:

- The DUT is in [DUT-READY] mode.

Steps:

1. The Test System calls the Reference App API to execute the action 4.12: Downloading three reference flies.

2. The Test System measures the time to successfully download each of the files, and whether each download was successful or not.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- File Download Operation: Whether the download operation is successful or not.

- File Download Time: The time elapsed since the user clicks download button until the file is stored in the DUT.

5.1.3.8 Play Live Video from User

Identifier: *DRA/SN/009*

Title: Play Live Video from User

Objective: Measure the user experience KPIs of the SNRA when running on the DUT while playing a live video from a user.

Applicability:

(ICSG_ProductType = Mobile device) AND ICSD_PlayVideo

Initial Conditions:

- The DUT is in [DUT-READY] mode.

Steps:

1. The Test System calls the Reference App API to execute the action 4.10: Play live video from a user.

2. The Test System measures the initial buffer, the number of re-buffering and the content resolution.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- Time to load first media frame: The time elapsed since the user clicks play button until the media reproduction starts.

- Playback Cut-off: Probability that successfully started stream reproduction is ended by a cause other than the intentional termination by the user.

- Content Stalling: The elapsed duration of content stalling while playing the content.

- Video resolution: Used video resolution.

5.1.3.9 Search Object

Identifier: *DRA/SN/010*

Title: Search Object

Objective: Measure the ability of the SNRA when running on the DUT to search the most relevant item for which the Reference App has been mainly designed (e.g., contacts, flights, hotels, etc.).

Applicability:

ICSG_ProductType = Mobile device

Initial Conditions:

- The DUT is in [DUT-READY] mode.

Steps:

1. The Test System calls the Reference App API to execute the action 4.13: Search object.

2. The Test System measures the search time.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- Search Time: The time elapsed since the user clicks search button until the first search result is shown.

- Search Operation: Whether the search operation is successful or not.

5.1.4 High Speed Internet

5.1.4.1 Downloading files sequentially

Identifier: *DRA/HS/001*

Title: Downloading files sequentially

Objective: Measure the user experience KPIs of the HSRA when running on the DUT while executing the feature file downloading in the High Speed Internet use case.

Applicability:

(ICSG_ProductType = Mobile device)

Initial Conditions:

- The DUT is in [DUT-READY] mode.

Steps:

1. The Test System calls the Reference App API to execute the action 5.1: Download three reference flies.

2. The Test System measures the time to successfully download each of the files, and whether each download was successful or not.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- File Download Operation: Whether the download operation is successful or not.

- File Download Time: The time elapsed since the user clicks download button until the file is stored in the DUT.

5.1.4.2 Uploading files sequentially

Identifier: *DRA/HS/002*

Title: Uploading files sequentially

Objective: Measure the user experience KPIs of the HSRA when running on the DUT while executing the feature file uploading in the High Speed Internet use case.

Applicability:

(ICSG_ProductType = Mobile device)

Initial Conditions:

- The DUT is in [DUT-READY] mode.

Steps:

1. The Test System calls the Reference App API to execute the action 5.2: Upload three reference flies.

2. The Test System measures the time to successfully upload each of the files, and whether each upload was successful or not.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- File Upload Operation: Whether the upload operation is successful or not.

- File Upload Time: The time elapsed since the user clicks upload button until the file is stored in the HSRA Backend Service.

5.1.4.3 Pause and Resume Download Transfer

Identifier: *DRA/HS/003*

Title: Pause and Resume Download Transfer

Objective: Measure the ability of the HSRA when running on the DUT to pause and the resume a file download.

Applicability:

(ICSG_ProductType = Mobile device)

Initial Conditions:

- The DUT is in [DUT-READY] mode.

Steps:

1. The Test System calls the Reference App API to execute the action 5.7 Pause and Resume one reference media file download.

2. The Test System measures whether the pause operation and the resume operation were successful or not.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- File Pause Download Operation: Whether the pause download operation is successful or not.

- File Resume Download Operation: Whether the resume download operation is successful or not.

5.1.4.4 Pause and Resume Upload Transfer

Identifier: *DRA/HS/004*

Title: Pause and Resume Upload Transfer

Objective: Measure the ability of the HSRA when running on the DUT to pause and the resume a file download.

Applicability:

(ICSG_ProductType = Mobile device)

Initial Conditions:

- The DUT is in [DUT-READY] mode.

Steps:

1. The Test System calls the Reference App API to execute the action 5.8 Pause and Resume one reference media file upload.

2. The Test System measures whether the pause operation and the resume operation were successful or not.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- File Pause Upload Operation: Whether the pause upload operation is successful or not.

- File Resume Upload Operation: Whether the resume upload operation is successful or not.

5.1.5 Virtual Reality

5.1.5.1 Virtual Experience Loading

Identifier: *DRA/VR/001*

Title: Virtual Experience Loading

Objective: Measure the ability of the VRRA when running on the DUT to look around with the three degrees of freedom from a single observation point.

Applicability:

(ICSG_ProductType = Mobile device) AND ICSD_VirtualReality

Initial Conditions:

- The DUT is in [DUT-READY] mode.

Steps:

1. The Test System calls the Reference App API to execute the action 6.1 Select virtual experience RVE1.

2. The Test System measures the time to recognize the target object.

3. The Test System spins up the DUT 30 degrees.

4. The Test System measures the time to recognize the target object.

5. The Test System spins down the DUT 60 degrees.

6. The Test System measures the time to recognize the target object.

7. The Test System spins up the DUT 30 degrees and spins left 60 degrees.

8. The Test System measures the time to recognize the target object.

9. The Test System spins right the DUT 120 degrees.

10. The Test System measures the time to recognize the target object.

11. The Test System spins left 60 degrees.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- Time to load the virtual world: Time elapsed from selecting a scenario (world, experience, etc.) to loading the 3D visual context.

- Immersion Cut-off: Probability that successfully started immersion is ended by a cause other than the intentional termination by the user.

5.1.5.2 Virtual Scene Loading

Identifier: *DRA/VR/002*

Title: Virtual Scene Loading

Objective: Measure the ability of the VRRA when running on the DUT to move horizontally from the initial observation point under the user control.

Applicability:

(ICSG_ProductType = Mobile device) AND ICSD_VirtualReality

Initial Conditions:

- The DUT is in [DUT-READY] mode.

Steps:

1. The Test System calls the Reference App API to execute the action 6.1 Select a virtual experience.

2. The Test System waits until the target object is recognized.

3. The Test System spins up the DUT a random number of degrees between 10 and 50.

4. The Test System waits until the target object is recognized.

5. The Test System commands the VRRA to move horizontally (walking speed, 4 km/h) during 20 seconds in order to change the scene.

6. The Test System measures the time to recognize the target object.

7. The Test System spins back the DUT to the original position.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- Time to load the virtual scene: Time elapsed from selecting a scenario (world, experience, etc.) to loading the 3D visual context.

- Immersion Cut-off: Probability that successfully started immersion is ended by a cause other than the intentional termination by the user.

- Video resolution: Used frame resolution.

5.1.6 Augmented Reality

5.1.6.1 Load Augmentation Layer on Physical Marker

Identifier: *DRA/AR/001*

Title: Load Augmentation Layer on physical marker

Objective: Measure the performance of the ARRA when running on the DUT to render a virtual layer on top of a moving physical marker.

Applicability:

(ICSG_ProductType = Mobile device) AND ICSD_AugmentedReality

Initial Conditions:

- The DUT is in [DUT-READY] mode.

Steps:

1. The Test System calls the Reference App API to execute the action 7.1 Load augmentation layer on a physical marker.
2. The Test System forces the DUT to aim at a physical maker.
3. The Test System measures the time elapsed by the ARRA to display a virtual layer on top of the physical marker.
4. The Test System spins (in any direction) the DUT 30 degrees, while the physical marker remains in the same position.
5. The Test System measures whether the ARRA keeps showing the virtual layer on top of the physical virtual or not.
6. The Test System spins back the DUT to the original position.
7. The Test System measures whether the ARRA keeps showing the virtual layer on top of the physical marker or not.
8. The Test System commands the ARRA to exit augmented reality mode.
9. The Test System measures whether the ARRA clears up the virtual layer or not.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- Time to load augmentation: Time elapsed from aiming the device at physical marker to displaying the virtual layer on top of it.

- Augmentation Cut-off: Probability that successfully started immersion is ended by a cause other than the intentional termination by the user.

- Clear Augmentation Layer Operation: Whether the clear virtual operation is successful or not.

5.1.6.2 Load Augmentation Layer at Location

Identifier: *DRA/AR/002*

Title: Load Augmentation Layer at Location

Objective: Measure the performance of the ARRA when running on the DUT to render a virtual layer at a specific location.

Applicability:

(ICSG_ProductType = Mobile device) AND ICSD_AugmentedReality

Initial Conditions:

- The DUT is in [DUT-READY] mode.

Steps:

1. The Test System calls the Reference App API to execute the action 7.2 Load augmentation layer at a specific location.

2. The Test System forces the DUT to be set at specific position.

3. The Test System measures the time elapsed by the ARRA to display a virtual layer at the current location.

4. The Test System commands the ARRA to exit augmented reality mode.

5. The Test System measures whether the ARRA clears up the virtual layer from the DUT screen or not.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- Time to load augmentation: Time elapsed from setting the DUT at a specfic locaiton to displaying the virtual layer.

- Augmentation Cut-off: Probability that successfully started immersion is ended by a cause other than the intentional termination by the user.

- Clear Augmentation Layer Operation: Whether the clear virtual operation is successful or not.

5.1.7 Gaming

5.1.7.1 Start two new game sessions

Identifier: *DRA/GA/001*

Title: Start new game session

Objective: Measure the ability of the GARA when running on the DUT to start new game sessions.

Applicability:

(ICSG_ProductType = Mobile device)

Initial Conditions:

- The DUT is in [DUT-READY] mode.
- GARA options are configured to their default values.
- Any GARA screen saving option is disabled.
- GARA resolution is configured to maximum resolution available.
- GARA Music and sound effects are configured to be ON.
- GARA energy saving options are disabled.

Steps:

1. The Test System calls the Reference App API to execute the action 10.6: Start two game sessions.
2. The Test System measures the time to successfully start the game the first time (including connection to server and loading).
3. The Test System measures the time to successfully start the game a second time.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- Time to load the first game: The time elapsed since the user clicks play button until the GARA loads the first game session and the user can start the interaction with the DUT for playing.
- First Time to load the second game: The time elapsed since the user clicks play button until the GARA loads the second game session and the user can start the interaction with the DUT for playing.
- Start Game Operation: Whether the game sessions are successfully loaded or not.

5.1.7.2 Long Game session

Identifier: *DRA/GA/002*

Title: LongGame session

Objective: Measure the ability of the GARA when running on the DUT to start new game session.

Applicability:

(ICSG_ProductType = Mobile device)

Initial Conditions:

- The DUT is in [DUT-READY] mode.

- GARA options are configured to their default values.

- Any GARA screen saving option is disabled.

- GARA resolution is configured to maximum resolution available.

- GARA Music and sound effects are configured to be on.

- No energy saving option is enabled in the GARA.

Steps:

1. The Test System calls the Reference App API to execute the action 7.3: Long game session.

2. The Test System measures the number of times and the duration that the game session stalls and the content resolution.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- Game Cut-off: Probability that successfully started gaming session is ended by a cause other than the intentional termination by the user.

- Game Content Stall: The elapsed duration of content stalling while executing the gaming session.

- Video resolution: Used video resolution.

5.1.7.3 Pause and Resume

Identifier: *DRA/GA/003*

Title: Interactive Play and Pause

Objective: Measure the ability of the GARA when running on the DUT to pause and the resume a game session.

Applicability:

(ICSG_ProductType = Mobile device)

Initial Conditions:

- The DUT is in [DUT-READY] mode.

- GARA options are configured to their default values.

- Any GARA screen saving option is disabled.

- GARA resolution is configured to maximum resolution available.

- GARA Music and sound effects are configured to be on.

- No energy saving option is enabled in the GARA.

Steps:

1. The Test System calls the Reference App API to execute the action 10.4: Pause and resume a game session.

2. The Test System measures whether pause operation and the resume operation were successful or not during step1.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- Pause Operation: Whether pause operation is successful or not.

- Resume Operation: Whether pause operation is successful or not.

- Time to load game session after resuming: The time elapsed since the user clicks resume button until the GARA user can resume the interaction with the DUT for playing.

5.1.7.4 Start saved game session

Identifier: *DRA/GA/004*

Title: Start saved game session

Objective: Measure the ability of the GARA when running on the DUT to start a saved game session.

Applicability:

(ICSG_ProductType = Mobile device)

Initial Conditions:

- The DUT is in [DUT-READY] mode.

- GARA options are configured to their default values.

- Any GARA screen saving option is disabled.

- GARA resolution is configured to maximum resolution available.

- GARA Music and sound effects are configured to be on.

- No energy saving option is enabled in the GARA.

Steps:

1. The Test System calls the Reference App API to execute the action 10.5: Saved game session.

2. The Test System measures the time to successfully start the game when starting the saved game version (including connection to server and loading).

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- Time to load the game: The time elapsed since the user clicks play button until the GARA loads the saved game session and the user can start the interaction with the DUT for playing.

- Start Game Operation: Whether the saved game session is successfully loaded or not.

5.2 Mobile devices Energy Consumption (DEC)

5.2.1 Common

The tests cases in this section apply to all Use Cases.

5.2.1.1 Device ON

Identifier: DEC*/CO/001*

Title: Device ON

Objective: Measure the energy that is consumed by the DUT when no App is running on it (other than the Apps that are running when switching on the device with the factory configuration).

Applicability:

(ICSG_ProductType = Mobile device)

Initial Conditions:

- DUT is in [DUT-ON] mode.

Steps:

1. The Test System measures the current consumption during 20 minutes.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- Current consumption: Record current samples during the measurement time and calculate the following values:
    o Average current consumption.
    o Standard deviation

5.2.1.2 Device ON with screen OFF

Identifier: DEC*/CO/002*

Title: Device ON with screen OFF

Objective: Measure the energy that is consumed by the DUT when no App is running on it (other than the Apps that are running when switching on the device with the factory configuration) and the screen of the DUT is OFF.

Applicability:

(ICSG_ProductType = Mobile device)

Initial Conditions:

- DUT is in [DUT-ON] mode.

Steps:

1. The Test Systems sets the DUT screen OFF.

2. The Test System measures the current consumption during 20 minutes.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- Current consumption: Record current samples during the measurement time and calculate the following values:
  - Average current consumption.
  - Standard deviation

5.2.1.3 Background state

Identifier: DEC*/CO/003*

Title: Background state

Objective: Measure the energy that is consumed by the DUT when several reference Apps are in background state.

Applicability:

(ICSG_ProductType = Mobile device)

Initial Conditions:

- DUT is in [DUT-READY] mode.

Steps:

1. The Test System calls the Reference App API to execute the action 1.3: Login.

2. The Test Systems sets the CSRA, SNRA, HSRA and VRRA reference Appa in background state.

3. The Test System performs the measurements defined below during 20 minutes with the reference Apps in background state.

4. The Test System sets the reference Apps back in active state.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- Current consumption: Record current samples during the measurement time and calculate the following values:
  - Average current consumption.
  - Standard deviation

5.2.2 CS Content Distribution Streaming Services

Note: The following test cases are defined to prevent any device-side content caching which the CSRA could implement. However, if the CSRA Backend Service also implements a server-side caching (e.g., storing the current playback time for a user), preventing that effect is left to the implementation of the test case.

5.2.2.1 Non Interactive Playback

Identifier: D*EC/CS/001*

Title: Non Interactive Playback

Objective: Measure the energy that is consumed by a CSRA while executing the feature media file playing from the Content Distribution Streaming Services use case.

Applicability:

(ICSG_ProductType = Mobile device) AND (ICSG_UseCases includes CS)

Initial Conditions:

- DUT is in [DUT-READY] mode.

Steps:

1. The Test System calls the Reference App API to execute the action 2.1: Play three reference media files.
2. The Test System measures the current consumed during the reproduction of the three reference videos.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- Current consumption: Record current samples during the measurement time and calculate the following values:
  - o Average current consumption.
  - o Standard deviation

5.2.2.2 Play and Pause

Identifier: DEC*/CS/002*

Title: Play and Pause

Objective: Measure the energy that is consumed by a CSRA when a media file is in pause mode.

Applicability:

(ICSG_ProductType = Mobile device) AND (ICSG_UseCases includes CS) AND ICSA_CSPause

Initial Conditions:

- DUT is in [DUT-READY] mode.

Steps:

1. The Test System calls the Reference App API to execute the action 2.2: Play and pause.

2. The Test System measures the current consumed during the period the reference video is in Pause mode.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- Current consumption: Record current samples during the measurement time and calculate the following values:
   - Average current consumption.
   - Standard deviation

5.2.2.3 Rewind

Identifier: DEC*/CS/003*

Title: Rewind

Objective: Measure the energy that is consumed by a CSRA when performing rewind operation while playing a media file.

Applicability:

(ICSG_ProductType = Mobile device) AND (ICSG_UseCases includes CS) AND ICSA_CSRewind

Initial Conditions:

- DUT is in [DUT-READY] mode.

Steps:

1. Test System calls the Reference App API to execute the action 2.9: Rewind.

2. The Test System measures the current consumed while the reproduction of the reference video is in rewind mode.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- Current consumption: Record current samples during the measurement time and calculate the following values:
   - Average current consumption.
   - Standard deviation

5.2.2.4 Download content for offline playing

Identifier: *DEC/CS/004*

Title: Download content for offline playing

Objective: Measure the energy that is consumed by a CSRA when downloading a media file for offline playing.

Applicability:

(ICSG_ProductType = Mobile device) AND (ICSG_UseCases includes CS) AND ICSA_CSDownloadMedia

Initial Conditions:

- DUT is in [DUT-READY] mode.

Steps:

1. The Test System calls the Reference App API to execute the action 2.4: Download a media file.

2. The Test System measures the current consumed while the media file is being downloaded.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- Current consumption: Record current samples during the measurement time and calculate the following values:
  - Average current consumption.
  - Standard deviation

5.2.2.5 Non Interactive Playback with screen off

Identifier: *DEC/CS/005*

Title: Non Interactive Playback with screen off

Objective: Measure the energy that is consumed by a CSRA while executing the feature media file playing from the Content Distribution Streaming Services use case and the screen is turned off.

Applicability:

(ICSG_ProductType = Mobile device) AND (ICSG_UseCases includes CS)

Initial Conditions:

- DUT is in [DUT-READY] mode.

DUT and/or CSRA may need to be configured so they can replay videos with screen off (e.g. DUT configured to send the video reproduction to an external screen)

Steps:

1. The Test System calls the Reference App API to execute the action 2.1: Play three reference media files.

2. Five seconds after the start of step 1, the Test Systems turns the DUT screen off and waits for 5 seconds.

3. The Test System measures the current consumed while the DUT is with the screen off and the video is being played.

Postamble:

- The Test System turns the DUT screen ON.

- Execute the Postamble sequence (see section 2.5).

Measurements:

- Current consumption: Record current samples during the measurement time and calculate the following values:

    o Average current consumption.

    o Standard deviation

5.2.2.6 Fast Forward

Identifier: DEC*/CS/006*

Title: Fast Forward

Objective: Measure the energy that is consumed by a CSRA when performing fast forward operation while playing a media file.

Applicability:

(ICSG_ProductType = Mobile device) AND (ICSG_UseCases includes CS) AND ICSA_CSFastForward

Initial Conditions:

- DUT is in [DUT-READY] mode.

Steps:

1. The Test System calls the Reference App API to execute the action 2.10: Fast Forward.

2. The Test System measures the current consumed while the reproduction of the reference video is in Fast Forward mode.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- Current consumption: Record current samples during the measurement time and calculate the following values:

    o Average current consumption.

    o Standard deviation

5.2.3 Live Streaming Services

5.2.3.1 Play Live Video from User

Identifier: *DEC/LS/001*

Title: Play Live Video from User

Objective: Measure the energy that is consumed by a LSRA while executing the feature live video playing from the Live Streaming Services use case.

Applicability:

(ICSG_ProductType = Mobile device) AND (ICSG_UseCases includes LS)

Initial Conditions:

- DUT is in [DUT-READY] mode.

- A live video is generated as defined in section 2.6.1.

Steps:

1. The Test System calls the Reference App API to execute the action 3.1: Play a live video.

2. The Test System measures the current consumed during the reproduction of the live video streaming.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- Current consumption: Record current samples during the measurement time and calculate the following values:
  - Average current consumption.
  - Standard deviation.

5.2.3.2 Broadcast Live Video

Identifier: *DEC/LS/002*

Title: Broadcast Live Video to User

Objective: Measure the energy that is consumed by a LSRA when broadcasting live content.

Applicability:

(ICSG_ProductType = Mobile device) AND (ICSG_UseCases includes LS)

Initial Conditions:

- DUT is in [DUT-READY] mode.

- The test case configuration is as defined in section 2.8.3 (Figure 3), with the DUT camera focused on the fixed TV pattern RTVP1.

Steps:

1. The Test System calls the Reference App API to execute the action 3.2: Broadcast live video.

2. The Test System measures the current consumed during the reproduction of the live video streaming.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- Current consumption: Record current samples during the measurement time and calculate the following values:
    - o Average current consumption.
    - o Standard deviation.

5.2.3.3 Broadcast live video with screen off

Identifier: *DEC/LS/003*

Title: Broadcast live video with screen off

Objective: Measure the energy that is consumed by a LSRA while executing the feature broadcast a live video from the Live Streaming Services use case when the screen is turned off.

Applicability:

(ICSG_ProductType = Mobile device) AND (ICSG_UseCases includes LS) AND ICSA_LSBroadcastScreenOff

Initial Conditions:

- DUT is in [DUT-READY] mode.

- The test case configuration is as defined in section 2.8.1 (Figure 3), with the DUT camera focused on the fixed TV pattern RTVP1.

Steps:

1. The Test System calls the Reference App API to execute the action 3.2: Broadcast live video.

2. After 10 seconds, the Test Systems turns the DUT screen off.

3. After the DUT screen is off, the Test System measures the current consumed by the DUT during 10 minutes.

Postamble:

- The Test System turns the DUT screen ON.

- Execute the Postamble sequence (see section 2.5).

Measurements:

- Current consumption: Record current samples during the measurement time and calculate the following values:

o   Average current consumption.

o   Standard deviation

5.2.4 Social Networking

5.2.4.1 Picture Posting

Identifier: *DEC/SN/001*

Title: Picture Posting

Objective: Measure the energy that is consumed by a SNRA while executing the feature picture posting in the Social Networking use case.

Applicability:

(ICSG_ProductType = Mobile device) AND (ICSG_UseCases includes SN) AND ICSA_SNPostImage

Initial Conditions:

*   DUT is in [DUT-READY] mode.

Steps:

1. The Test System calls the Reference App API to execute the action 4.2: Post pictures.

2. The Test System measures the current consumed while the pictures are being posted.

Postamble:

*   Execute the Postamble sequence (see section 2.5).

Measurements:

*   Current consumption: Record current samples during the measurement time and calculate the following values:

    o   Average current consumption.

    o   Standard deviation.

5.2.4.2 Video Posting

Identifier: *DEC/SN/002*

Title: Video Uploading

Objective: Measure the energy that is consumed by a SNRA while executing the feature vdeo posting in the Social Networking use case.

Applicability:

(ICSG_ProductType = Mobile device) AND (ICSG_UseCases includes SN) AND ICSA_SNPostVideo

Initial Conditions:

*   DUT is in [DUT-READY] mode.

Steps:

1. The Test System calls the Reference App API to execute the action 4.3: Post videos sequentially.

2. The Test System measures the current consumed while the videos are being posted.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- Current consumption: Record current samples during the measurement time and calculate the following values:
  - ○ Average current consumption.
  - ○ Standard deviation.

5.2.4.3 File Posting

Identifier: *DEC/SN/003*

Title: File Posting

Objective: Measure the energy that is consumed by a SNRA while executing the feature file posting in the Social Networking use case.

Applicability:

(ICSG_ProductType = Mobile device) AND (ICSG_UseCases includes SN) AND ICSA_SNPostFile.

Initial Conditions:

- DUT is in [DUT-READY] mode.

Steps:

1. The Test System calls the Reference App API to execute the action 4.6: Post three reference files separately.

2. The Test System measures the current consumed while the files are being posted.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- Current consumption: Record current samples during the measurement time and calculate the following values:
  - ○ Average current consumption.
  - ○ Standard deviation.

5.2.4.4 Show Picture

Identifier: *DEC/SN/004*

Title: Show Picture

Objective: Measure the energy that is consumed by a SNRA while executing the feature show picture (downloading) in the Social Networking use case.

Applicability:

(ICSG_ProductType = Mobile device) AND (ICSG_UseCases includes SN) AND ICSA_SNGetImage

Initial Conditions:

- DUT is in [DUT-READY] mode.

Steps:

1. The Test System calls the Reference App API to execute the action 4.8: Get three reference pictures.
2. The Test System measures the current consumed while the pictures are being downloaded and until the pictures are completely displayed at their final resolution.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- Current consumption: Record current samples during the measurement time and calculate the following values:
  - Average current consumption.
  - Standard deviation.

5.2.4.5 Play Video

Identifier: *DEC/SN/005*

Title: Play Video

Objective: Measure the energy that is consumed by a SNRA while executing the feature play video in the Social Networking use case.

Applicability:

(ICSG_ProductType = Mobile device) AND (ICSG_UseCases includes SN) AND ICSA_SNGetVideo

Initial Conditions:

- DUT is in [DUT-READY] mode.

Steps:

1. The Test System calls the Reference App API to execute the action 4.9 Play three reference videos.
2. The Test System measures the current consumed while the videos are being played.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- Current consumption: Record current samples during the measurement time and calculate the following values:
  - Average current consumption.
  - Standard deviation.

5.2.4.6 File Downloading

Identifier: *DEC/SN/006*

Title: File Downloading

Objective: Measure the energy that is consumed by a SNRA while executing the feature file downloading in the Social Networking use case.

Applicability:

(ICSG_ProductType = Mobile device) AND (ICSG_UseCases includes SN) AND ICSA_SNGetFile

Initial Conditions:

- DUT is in [DUT-READY] mode.

Steps:

1. The Test System calls the Reference App API to execute the action 4.12: Downloading three reference flies.
2. The Test System measures the current consumed while the files are being downloaded.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- Current consumption: Record current samples during the measurement time and calculate the following values:
  - Average current consumption.
  - Standard deviation.

5.2.5 High Speed Internet

5.2.5.1 Downloading files sequentially

Identifier: *DEC/HS/001*

Title: Downloading files sequentially

Objective: Measure the energy that is consumed by a HSRA while executing the feature downloading files sequentially in the High Speed Internet use case.

Applicability:

(ICSG_ProductType = Mobile device) AND (ICSG_UseCases includes HS)

Initial Conditions:

- DUT is in [DUT-READY] mode.

Steps:

1. The Test System calls the Reference App API to execute the action 5.1: Download three reference flies.

2. The Test System measures the current consumed while the files are being downloaded.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- Current consumption: Record current samples during the measurement time and calculate the following values:
    - Average current consumption.
    - Standard deviation.

5.2.5.2 Uploading files sequentially

Identifier: D*EC/ HS/002*

Title: Uploading files sequentially

Objective: Measure the energy that is consumed by a HSRA while executing the feature uploading files sequentially in the High Speed Internet use case.

Applicability:

(ICSG_ProductType = Mobile device) AND (ICSG_UseCases includes HS)

Initial Conditions:

- DUT is in [DUT-READY] mode.

Steps:

1. The Test System calls the Reference App API to execute the action 5.2: Upload three reference flies.

2. The Test System measures the current consumed while the files are being uploaded.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- Current consumption: Record current samples during the measurement time and calculate the following values:
    - Average current consumption.
    - Standard deviation.

5.2.5.3 Downloading several files simultaneously

Identifier: *DEC/ HS/003*

Title: Downloading several files simultaneously

Objective: Measure the energy that is consumed by a HSRA while executing the feature downloading several files simultaneously in the High Speed Internet use case.

Applicability:

(ICSG_ProductType = Mobile device) AND (ICSG_UseCases includes HS)

Initial Conditions:

- DUT is in [DUT-READY] mode.

Steps:

1. The Test System calls the Reference App API to execute the action 5.3: Download several reference flies simultaneously.

2. The Test System measures the current consumed while the files are being downloaded.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- Current consumption: Record current samples during the measurement time and calculate the following values:
  - o Average current consumption.
  - o Standard deviation.

5.2.5.4 Uploading several files simultaneously

Identifier: *DEC/ HS/004*

Title: Uploading several files simultaneously

Objective: Measure the energy that is consumed by a HSRA while executing the feature uploading several files simultaneously in the High Speed Internet use case.

Applicability:

(ICSG_ProductType = Mobile device) AND (ICSG_UseCases includes HS)

Initial Conditions:

- DUT is in [DUT-READY] mode.

Steps:

1. The Test System calls the Reference App API to execute the action 5.4: Upload several reference flies simultaneously.

2. The Test System measures the current consumed while the files are being uploaded.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- Current consumption: Record current samples during the measurement time and calculate the following values:

  - Average current consumption.

  - Standard deviation.

5.2.5.5 Downloading a file with screen off

Identifier: *DEC/ HS/005*

Title: Downloading a file with screen off

Objective: Measure the energy that is consumed by a HSRA while executing the feature downloading a file in the High Speed Internet use case with the screen off.

Applicability:

(ICSG_ProductType = Mobile device) AND (ICSG_UseCases includes HS)

Initial Conditions:

- DUT is in [DUT-READY] mode.

Steps:

1. The Test System calls the Reference App API to execute the action 5.5: Download a huge file.

2. Five seconds after the start of step 1, The Test System starts measuring the current consumed while the file is being downloaded.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- Current consumption: Record current samples during the measurement time and calculate the following values:

  - Average current consumption.

  - Standard deviation.

5.2.5.6 Uploading a file with screen off

Identifier: *DEC/ HS/006*

Title: Uploading a file with screen off

Objective: Measure the energy that is consumed by a HSRA while executing the feature uploading a file in the High Speed Internet use case with the screen off.

Applicability:

(ICSG_ProductType = Mobile device) AND (ICSG_UseCases includes HS)

Initial Conditions:

- DUT is in [DUT-READY] mode.

Steps:

1. The Test System calls the Reference App API to execute the action 5.6: Download a huge file.

2. Five seconds after the start of step 1, The Test System start measuring the current consumed while the file is being uploaded.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- Current consumption: Record current samples during the measurement time and calculate the following values:
  - Average current consumption.
  - Standard deviation.

5.2.6 Virtual Reality

5.2.6.1 Virtual Experience Loading

Identifier: *DEC/VR/001*

Title: Virtual Experience Loading

Objective: Measure the energy that is consumed by a VRRA while loading a Virtual experience from a single point.

Applicability:

(ICSG_ProductType = Mobile device) AND (ICSG_UseCases includes VR)

Initial Conditions:

- DUT is in [DUT-READY] mode.

Steps:

1. The Test System calls the Reference App API to execute the action 6.1 Select a virtual experience.

2. The Test System waits until the reference App recognizes the target object

3. The Test System spins up the DUT 30 degrees, and waits until the reference App recognizes the target object.

4. The Test System spins down the DUT 60 degrees and waits until the reference App recognizes the target object.

5. The Test System spins up the DUT 30 degrees and spins left 60 degrees and waits until the reference App recognizes the target object.

6. The Test System spins right the DUT 120 degrees and waits until the reference App recognizes the target object.

7. The Test System spins left the DUT 60 degrees and waits until the reference App recognizes the target object.

8. The Test System measures the current consumed by the DUT from step 1 to step 7.

9. The Test System spins back the DUT to the original position.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- Current consumption: Record current samples during the measurement time and calculate the following values:
    - Average current consumption.
    - Standard deviation.

- Time to load the virtual experience.

5.2.6.2 Virtual Scene Loading

Identifier: *DEC/VR/002*

Title: Virtual Scene Loading

Objective: Measure the energy that is consumed by a VRRA while moving horizontally from the initial observation point under the user control.

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Applicability:

(ICSG_ProductType = Mobile device) AND (ICSG_UseCases includes VR)

Initial Conditions:

- DUT is in [DUT-READY] mode.

Steps:

1. The Test System calls the Reference App API to execute the action 6.1 Select a virtual experience.

2. The Test System waits until the target object is recognized.

3. The Test System spins up the DUT a random number of degrees between 10 and 50.

4. The Test System waits until the target object is recognized.

5. The Test System commands the reference App to move horizontally (walking speed, 4 km/h) during 20 seconds in order to change the scene.

6. The Test System measures the current consumed by the DUT during step 5 execution.

7. The Test System spins back the DUT to the original position.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- Current consumption: Record current samples during the measurement time and calculate the following values:
  - o Average current consumption.
  - o Standard deviation.

5.2.7 Augmented Reality

5.2.7.1 Load augmentation layer on a physical marker

Identifier: *DEC/AR/001*

Title: Load augmentation layer on a physical marker

Objective: Measure the energy that is consumed by an ARRA to render a virtual layer on top of a moving physical marker.

Applicability:

(ICSG_ProductType = Mobile device) AND (ICSG_UseCases includes AR)

Initial Conditions:

- DUT is in [DUT-READY] mode.

Steps:

1. The Test System calls the Reference App API to execute the action 7.1 Load augmentation layer on a physical marker.

2. The Test System measures the current consumed until the App displays a virtual layer on top of the physical marker.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- Current consumption: Record current samples during the measurement time and calculate the following values:
  - o Average current consumption.
  - o Standard deviation.

5.2.7.2 Load Augmentation Layer at Location

Identifier: *DEC/AR/002*

Title: Load Augmentation Layer at location

Objective: Measure the energy that is consumed by an ARRA to render a virtual layer at a specific location.

Applicability:

(ICSG_ProductType = Mobile device) AND (ICSG_UseCases includes AR)

Initial Conditions:

- DUT is in [DUT-READY] mode.

Steps:

1. The Test System calls the Reference App API to execute the action 7.2 Load augmentation layer at a specific location.

2. The Test System measures the current consumed by the DUT until the App displays a virtual layer at the location specified.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- Current consumption: Record current samples during the measurement time and calculate the following values:
  - Average current consumption.
  - Standard deviation.

5.2.7.3 Augmented reality session

Identifier: *DEC/AR/003*

Title: Augmented reality session

Objective: Measure the energy that is consumed by an ARRA during an augmented reality session.

Applicability:

(ICSG_ProductType = Mobile device) AND (ICSG_UseCases includes AR)

Initial Conditions:

- DUT is in [DUT-READY] mode.

Steps:

1. The Test System calls the Reference App API to execute the action 7.1 Load augmentation layer on a physical marker.

2. The Test System spins (in one of the three axis) the DUT 15 degrees, while the physical marker remains in the same position.

3. The Test Systems wait for 5 seconds

4. The Test System measures the current consumption in steps 2 and 3, and whether the reference App keeps showing the virtual layer on top of the physical marker.

5. The Test System spins in the same axis the DUT 30 degrees in the opposite direction, while the physical marker remains in the same position.

6. The Test Systems wait for 5 seconds

7. The Test System measures the current consumption in steps 5 and 6 and whether the reference App keeps showing the virtual layer on top of the physical virtual.

8. The Test System spins the DUT back to the original position.

9. The Test System spins back to the original position.

10. The Test System repeat steps 2 to 9 in the other two axis.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- Current consumption: Record current samples during the measurement time and calculate the following values:
  - o Average current consumption.
  - o Standard deviation.

5.2.8 Gaming

5.2.8.1 Start Game session

Identifier: *DEC/GA/001*

Title: Start game session

Objective: Measure the energy that is consumed by a GARA while starting a game session.

Applicability:

(ICSG_ProductType = Mobile device) AND (ICSG_UseCases includes GA)

Initial Conditions:

- DUT is in [DUT-READY] mode.

- Reference App options are configured to their default values.

- Any reference App screen saving option is disabled.

- Reference App resolution is configured to maximum resolution available.

- Reference App Music and sound effects are configured to be ON.

- No energy saving option is enabled in the Reference App.

Steps:

1. The Test System calls the Reference App API to execute the action 10.1: Start game session.

2. The Test System measures the current consumed by the DUT while the game session is being started.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- Current consumption: Record current samples during the measurement time and calculate the following values:
  - o Average current consumption.
  - o Standard deviation.

5.2.8.2 Short Game session

Identifier: *DEC/GA/002*

Title: Short Game session

Objective: Measure the energy that is consumed by a GARA while playing a short game session.

Applicability:

(ICSG_ProductType = Mobile device) AND (ICSG_UseCases includes LS)

Initial Conditions:

- DUT is in [DUT-READY] mode.

- Reference App options are configured to their default values.

- Any reference App screen saving option is disabled.

- Reference App resolution is configured to maximum resolution available.

- Reference App Music and sound effects are configured to be ON.

- No energy saving option is enabled in the reference App.

Steps:

1. The Test System calls the Reference App API to execute the action 7.2: Short game session.

2. The Test System measures the current consumed while the game session is being played.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- Current consumption: Record current samples during the measurement time and calculate the following values:
  - Average current consumption.
  - Standard deviation.

5.2.8.3 Long Game session

Identifier: *DEC/GA/003*

Title: Long Game session

Objective: Measure the energy that is consumed by a GARA while playing a long game session.

Applicability:

(ICSG_ProductType = Mobile device) AND (ICSG_UseCases includes LS)

Initial Conditions:

- DUT is in [DUT-READY] mode.

- Reference App options are configured to their default values.

- Any reference App screen saving option is disabled.

- Reference App resolution is configured to maximum resolution available.

- Reference App Music and sound effects are configured to be ON.

- No energy saving option is enabled in the reference App.

Steps:

1. The Test System calls the Reference App API to execute the action 7.3: Long game session.

2. The Test System measures the current consumed while the game session is being played.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- Current consumption: Record current samples during the measurement time and calculate the following values:

  o Average current consumption.

  o Standard deviation.

5.3 Mobile Devices Radio Performance (RFP)

5.3.1 High Speed Internet

5.3.1.1 Sensitivity

Identifier: RFP*/HS/001*

Title: Sensitivity

Objective: Measure the Test System power level received by the DUT at which it is able to provide a defined *target throughput* while executing the feature file downloading in the High Speed Internet use case.

Target throughput is ≥ 95% of the maximum throughput of the reference measurement channel (Max. Throughput averaged over frame: 1952.8)).

Applicability:

(ICSG_ProductType = Mobile device)

Initial Conditions:

- The DUT is in [DUT-READY] mode.
- The Test System is configured in Network Scenario '*Very low coverage*' as defined in section 2.2.

Steps:

1. The Test System sends a data file to the DUT by the use of the Reference App (e.g. using the Reference App API).
2. The Test System measures the received throughput at the DUT side during a *Throughput Measurement time* of 30 seconds.
3. If the average measured throughput is below *Target Throughput* the test case ends.
4. If the average measured throughput is above <1.2**Target Throughput*> the Test System power level is decreased *1* dB.
5. If the average measured throughput is equal or below <1.2**Target Throughput*> the Test System power level is decreased *0.2* dB*.
6. *The Test System waits for 5 seconds.*
7. *Jump to step 2.*

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- Throughput: Measures the average speed of the network connecting wihile performing the file downloading operation during the measurement time in bits per second.
- Sensitivity level: The maximum power level in dBm at which the DUT is able to receive the Test System Transmission with throughput over *Target Throughput (i.e. the power level of the Test System in the penultimate measurement)*.

5.3.1.2 Adjacent Channel Selectivity

Identifier: RFP*/HS/002*

Title: Adjacent Channel Selectivity.

Objective: Measure the power level from an interferer signal received by the DUT at which it is able to provide a defined *target throughput* while executing the feature file downloading in the High Speed Internet use case.

Target throughput is ≥ 95% of the maximum throughput of the reference measurement channel (Max. Throughput averaged over frame: 1952.8)).

Applicability:

(ICSG_ProductType = Mobile device)

Initial Conditions:

- The DUT is in [DUT-READY] mode.

Steps:

1. The Test System measures the use of network resources during 20 minutes with no reference App running and the DUT switched on.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- DL IP data usage: Total number of bytes transferred in the DL during the measurement time.

- UL IP data usage: Total number of bytes transferred in the UL during the measurement time.

5.4.2   CS Content Distribution Streaming Services

Note: The following test cases are defined to prevent any device-side content caching which the CSRA could implement. However, if the CSRA Backend Service also implements a server-side caching (e.g., storing the current playback time for a user), preventing that effect is left to the implementation of the test case.

5.4.2.1 Non Interactive Playback

Identifier: DDP*/CS/001*

Title: Non Interactive Playback

Objective: Measure the network resources consumed by the DUT using a CSRA to execute the feature media file playing from the Content Distribution Streaming Services use case.

Applicability:

(ICSG_ProductType = Mobile device) AND (ICSG_UseCases includes CS)

Initial Conditions:

- DUT is in [DUT-READY] mode.

Steps:

1. The Test System calls the CSRA API to execute the action 2.1: Play three reference media files.

2. The Test System measures the network resources consumed during the reproduction of the three reference videos.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- DL IP data usage: Total number of bytes transferred in the DL during the measurement time.

- UL IP data usage: Total number of bytes transferred in the UL during the measurement time.

5.4.2.2 Play and Pause

Identifier: DDP*/CS/002*

Title: Play and Pause

Objective: Measure the network resources consumed by the DUT using a CSRA when a media file is in pause mode.

Applicability:

(ICSG_ProductType = Mobile device) AND (ICSG_UseCases includes CS) AND ICSA_CSPause

Initial Conditions:

- DUT is in [DUT-READY] mode.

Steps:

1. The Test System calls the Reference App API to execute the action 2.2: Play and pause.
2. The Test System measures the network resources consumed during the period the reference video is in Pause mode.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- DL IP data usage: Total number of bytes transferred in the DL during the measurement time.
- UL IP data usage: Total number of bytes transferred in the UL during the measurement time.

5.4.2.3 Rewind

Identifier: DDP*/CS/003*

Title: Rewind

Objective: Measure the network resources consumed by the DUT using a CSRA to execute a rewind operation while playing a media file.

Applicability:

(ICSG_ProductType = Mobile device) AND (ICSG_UseCases includes CS) AND ICSA_CSRewind

Initial Conditions:

- DUT is in [DUT-READY] mode.

Steps:

1. The Test System calls the Reference App API to execute the action 2.9: Rewind.

2. The Test System measures the network resources consumed while the reproduction of the reference video is in rewind mode.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- DL IP data usage: Total number of bytes transferred in the DL during the measurement time.

- UL IP data usage: Total number of bytes transferred in the UL during the measurement time.

5.4.2.4 Download content for offline playing

Identifier: DDP*/CS/004*

Title: Download content for offline playing

Objective: Measure the network resources consumed by the DUT using a CSRA when downloading a media file for offline playing.

Applicability:

(ICSG_ProductType = Mobile device) AND (ICSG_UseCases includes CS) AND ICSA_CSDownloadMedia

Initial Conditions:

- DUT is in [DUT-READY] mode.

Steps:

1. The Test System calls the Reference App API to execute the action 2.4: Download a media file.

2. The Test System measures the network resources consumed while the media file is being downloaded.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- DL IP data usage: Total number of bytes transferred in the DL during the measurement time.

- UL IP data usage: Total number of bytes transferred in the UL during the measurement time.

5.4.2.5 Fast Forward

Identifier: DDP*/CS/005*

Title: Fast Forward

Objective: Measure the network resources consumed by the DUT using a CSRA when performing fast forward operation while playing a media file.

Applicability:

(ICSG_ProductType = Mobile device) AND (ICSG_UseCases includes CS) AND ICSA_CSFastForward

Initial Conditions:

- DUT is in [DUT-READY] mode.

Steps:

1. The Test System calls the Reference App API to execute the action 2.10: Fast Forward.
2. The Test System measures the network resources consumed while the reproduction of the reference video is in Fast Forward mode.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- DL IP data usage: Total number of bytes transferred in the DL during the measurement time.
- UL IP data usage: Total number of bytes transferred in the UL during the measurement time.

5.4.3   Live Streaming Services

5.4.3.1 Play Live Video from User

Identifier: *DDP/LS/001*

Title: Play Live Video from User

Objective: Measure the network resources consumed by the DUT using a LSRA to execute the feature live video playing from the Live Streaming Services use case with a reference App.

Applicability:

(ICSG_ProductType = Mobile device) AND (ICSG_UseCases includes LS)

Initial Conditions:

- DUT is in [DUT-READY] mode.
- A live video is generated as defined in section 2.6.1.

Steps:

1. The Test System calls the Reference App API to execute the action 3.1: Play a live video.
2. The Test System measures the network resources consumed during the reproduction of the live video streaming.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- DL IP data usage: Total number of bytes transferred in the DL during the measurement time.

- UL IP data usage: Total number of bytes transferred in the UL during the measurement time.

5.4.3.2 Broadcast Live Video

Identifier: *DDP/LS/002*

Title: Broadcast Live Video to User

Objective: Measure the network resources consumed by the DUT using a LSRA to broadcast live content.

Applicability:

(ICSG_ProductType = Mobile device) AND (ICSG_UseCases includes LS)

Initial Conditions:

- DUT is in [DUT-READY] mode.

- The test case configuration is as defined in section 2.8.3 (Figure 3), with the DUT camera focused on the fixed TV pattern RTVP1.

Steps:

1. The Test System calls the Reference App API to execute the action 3.2: Broadcast live video.

2. The Test System measures the network resources consumed during the reproduction of the live video streaming.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- DL IP data usage: Total number of bytes transferred in the DL during the measurement time.

- UL IP data usage: Total number of bytes transferred in the UL during the measurement time.

5.4.3.3 Broadcast live video with screen off

Identifier: *DDP/LS/003*

Title: Broadcast live video with screen off

Objective: Measure the network resources consumed by the DUT using a LSRA to execute the feature broadcast a live video from the Live Streaming Services use case when the screen is turned off.

Applicability:

(ICSG_ProductType = Mobile device) AND (ICSG_UseCases includes LS) AND ICSA_LSBroadcastScreenOff

Initial Conditions:

- DUT is in [DUT-READY] mode.

- The test case configuration is as defined in section 2.8.3 (Figure 3), with the DUT camera focused on the fixed TV pattern RTVP1.

Steps:

1. The Test System calls the Reference App API to execute the action 3.2: Broadcast live video.

2. After 10 seconds, the Test Systems turns the DUT screen off.

3. After the DUT screen is off, the Test System measures the network resources consumed by the DUT during 10 minutes.

Postamble:

- The Test System turns the DUT screen ON.

- Execute the Postamble sequence (see section 2.5).

Measurements:

- DL IP data usage: Total number of bytes transferred in the DL during the measurement time.

- UL IP data usage: Total number of bytes transferred in the UL during the measurement time.

5.4.4 Social Networking

5.4.4.1 Picture Posting

Identifier: *DDP/SN/001*

Title: Picture Posting

Objective: Measure the network resources consumed by the DUT using a SNRA to execute the feature picture posting in the Social Networking use case.

Applicability:

(ICSG_ProductType = Mobile device) AND (ICSG_UseCases includes SN) AND ICSA_SNPostImage

Initial Conditions:

- DUT is in [DUT-READY] mode.

Steps:

1. The Test System calls the Reference App API to execute the action 4.2: Post pictures.

2. The Test System measures the network resources consumed while the pictures are being posted.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- DL IP data usage: Total number of bytes transferred in the DL during the measurement time.

- UL IP data usage: Total number of bytes transferred in the UL during the measurement time.

5.4.4.2 Video Posting

Identifier: *DDP/SN/002*

Title: Video Uploading

Objective Measure the network resources consumed by the DUT using a SNRA to execute the feature video posting in the Social Networking use case.

Applicability:

(ICSG_ProductType = Mobile device) AND (ICSG_UseCases includes SN) AND ICSA_SNPostVideo

Initial Conditions:

- DUT is in [DUT-READY] mode.

Steps:

1. The Test System calls the Reference App API to execute the action 4.3: Post videos sequentially.

2. The Test System measures the network resources consumed while the videos are being posted.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- DL IP data usage: Total number of bytes transferred in the DL during the measurement time.

- UL IP data usage: Total number of bytes transferred in the UL during the measurement time.

5.4.4.3 File Posting

Identifier: *DDP/SN/003*

Title: File Posting

Objective: Measure the network resources consumed by the DUT using a SNRA to execute the feature file posting in the Social Networking use case.

Applicability:

(ICSG_ProductType = Mobile device) AND (ICSG_UseCases includes SN) AND ICSA_SNPostFile.

Initial Conditions:

- DUT is in [DUT-READY] mode.

Steps:

1. The Test System calls the Reference App API to execute the action 4.6: Post three reference files separately.

2. The Test System measures the network resources consumed while the files are being posted.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- DL IP data usage: Total number of bytes transferred in the DL during the measurement time.

- UL IP data usage: Total number of bytes transferred in the UL during the measurement time.

5.4.4.4 Show Picture

Identifier: *DDP/SN/004*

Title: Show Picture

Objective: Measure the network resources consumed by the DUT using a SNRA to execute the feature show picture (downloading) in the Social Networking use case.

Applicability:

(ICSG_ProductType = Mobile device) AND (ICSG_UseCases includes SN) AND ICSA_SNGetImage

Initial Conditions:

- DUT is in [DUT-READY] mode.

Steps:

1. The Test System calls the Reference App API to execute the action 4.8: Get three reference pictures.

2. The Test System measures the network resources consumed while the pictures are being downloaded and until the pictures are completely displayed at their final resolution.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- DL IP data usage: Total number of bytes transferred in the DL during the measurement time.

- UL IP data usage: Total number of bytes transferred in the UL during the measurement time.

5.4.4.5 Play Video

Identifier: *DDP/SN/005*

Title: Play Video

Objective: Measure the network resources consumed by the DUT using a SNRA to execute the feature play video in the Social Networking use case.

Applicability:

(ICSG_ProductType = Mobile device) AND (ICSG_UseCases includes SN) AND ICSA_SNGetVideo

Initial Conditions:

- DUT is in [DUT-READY] mode.

Steps:

1. The Test System calls the Reference App API to execute the action 4.9 Play three reference videos.
2. The Test System measures the network resources consumed while the videos are being played.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- DL IP data usage: Total number of bytes transferred in the DL during the measurement time.
- UL IP data usage: Total number of bytes transferred in the UL during the measurement time.

5.4.4.6 File Downloading

Identifier: *DDP/SN/006*

Title: File Downloading

Objective Measure the network resources consumed by the DUT using a SNRA to execute the feature file downloading in the Social Networking use case.

Applicability:

(ICSG_ProductType = Mobile device) AND (ICSG_UseCases includes SN) AND ICSA_SNGetFile

Initial Conditions:

- DUT is in [DUT-READY] mode.

Steps:

1. The Test System calls the Reference App API to execute the action 4.12: Downloading three reference flies.

2. The Test System measures the network resources consumed while the files are being downloaded.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- DL IP data usage: Total number of bytes transferred in the DL during the measurement time.

- UL IP data usage: Total number of bytes transferred in the UL during the measurement time.

5.4.5   High Speed Internet

5.4.5.1   Downloading files sequentially

Identifier: *DDP/HS/001*

Title: Downloading files sequentially

Objective: Measure the network resources consumed by the DUT using a HSRA to execute the feature downloading files sequentially in the High Speed Internet use case.

Applicability:

(ICSG_ProductType = Mobile device) AND (ICSG_UseCases includes HS)

Initial Conditions:

- DUT is in [DUT-READY] mode.

Steps:

1. The Test System calls the Reference App API to execute the action 5.1: Download three reference flies.

2. The Test System measures the network resources consumed while the files are being downloaded.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- DL IP data usage: Total number of bytes transferred in the DL during the measurement time.

- UL IP data usage: Total number of bytes transferred in the UL during the measurement time.

5.4.5.2 Uploading files sequentially

Identifier: DDP/ *HS/002*

Title: Uploading files sequentially

Objective: Measure the network resources consumed by the DUT using a HSRA to execute the feature uploading files sequentially in the High Speed Internet use case.

Applicability:

(ICSG_ProductType = Mobile device) AND (ICSG_UseCases includes HS)

Initial Conditions:

- DUT is in [DUT-READY] mode.

Steps:

1. The Test System calls the Reference App API to execute the action 5.2: Upload three reference flies.

2. The Test System measures the network resources consumed while the files are being uploaded.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- DL IP data usage: Total number of bytes transferred in the DL during the measurement time.

- UL IP data usage: Total number of bytes transferred in the UL during the measurement time.

5.4.5.3 Downloading several files simultaneously

Identifier: *DDP/ HS/003*

Title: Downloading several files simultaneously

Objective: Measure the network resources consumed by the DUT using a HSRA to execute the feature downloading several files simultaneously in the High Speed Internet use case.

Applicability:

(ICSG_ProductType = Mobile device) AND (ICSG_UseCases includes HS)

Initial Conditions:

- DUT is in [DUT-READY] mode.

Steps:

1. The Test System calls the Reference App API to execute the action 5.3: Download several reference flies simultaneously.

2. The Test System measures the network resources consumed while the files are being downloaded.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- DL IP data usage: Total number of bytes transferred in the DL during the measurement time.

- UL IP data usage: Total number of bytes transferred in the UL during the measurement time.

5.4.5.4 Uploading several files simultaneously

Identifier: *DDP/ HS/004*

Title: Uploading several files simultaneously

Objective: Measure the network resources consumed by the DUT using a HSRA to execute the feature uploading several files simultaneously in the High Speed Internet use case.

Applicability:

(ICSG_ProductType = Mobile device) AND (ICSG_UseCases includes HS)

Initial Conditions:

- DUT is in [DUT-READY] mode.

Steps:

1. The Test System calls the Reference App API to execute the action 5.4: Upload several reference flies simultaneously.

2. The Test System measures the network resources consumed while the files are being uploaded.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- DL IP data usage: Total number of bytes transferred in the DL during the measurement time.

- UL IP data usage: Total number of bytes transferred in the UL during the measurement time.

5.4.5.5 Downloading a file with screen off

Identifier: *DDP/ HS/005*

Title: Downloading a file with screen off

Objective: Measure the network resources consumed by the DUT using a HSRA to execute the feature downloading a file in the High Speed Internet use case with the screen off.

Applicability:

(ICSG_ProductType = Mobile device) AND (ICSG_UseCases includes HS)

Initial Conditions:

- DUT is in [DUT-READY] mode.

Steps:

1. The Test System calls the Reference App API to execute the action 5.5: Download a huge file.

2. Five seconds after the start of step 1, The Test System starts measuring the network resources consumed while the file is being downloaded.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- DL IP data usage: Total number of bytes transferred in the DL during the measurement time.

- UL IP data usage: Total number of bytes transferred in the UL during the measurement time.

5.4.5.6 Uploading a file with screen off

Identifier: *DDP/ HS/006*

Title: Uploading a file with screen off

Objective: Measure the network resources consumed by the DUT using a HSRA to execute the feature uploading a file in the High Speed Internet use case with the screen off.

Applicability:

(ICSG_ProductType = Mobile device) AND (ICSG_UseCases includes HS)

Initial Conditions:

- DUT is in [DUT-READY] mode.

Steps:

1. The Test System calls the Reference App API to execute the action 5.6: Download a huge file.

2. Five seconds after the start of step 1, The Test System start measuring the network resources consumed while the file is being uploaded.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- DL IP data usage: Total number of bytes transferred in the DL during the measurement time.

- UL IP data usage: Total number of bytes transferred in the UL during the measurement time.

5.4.6 Virtual Reality

5.4.6.1 Virtual Experience Loading

Identifier: *DDP/VR/001*

Title: Virtual Experience Loading

Objective: Measure the network resources consumed by the DUT using a VRRA to load a Virtual experience from a single point.

Applicability:

(ICSG_ProductType = Mobile device) AND (ICSG_UseCases includes VR)

Initial Conditions:

- DUT is in [DUT-READY] mode.

Steps:

1. The Test System calls the Reference App API to execute the action 6.1 Select a virtual experience.

2. The Test System waits until the reference App recognizes the target object

3. The Test System spins up the DUT 30 degrees, and waits until the reference App recognizes the target object.

4. The Test System spins down the DUT 60 degrees and waits until the reference App recognizes the target object.

5. The Test System spins up the DUT 30 degrees and spins left 60 degrees and waits until the reference App recognizes the target object.

6. The Test System spins right the DUT 120 degrees and waits until the reference App recognizes the target object.

7. The Test System spins left the DUT 60 degrees and waits until the reference App recognizes the target object.

8. The Test System measures the network resources consumed by the DUT from step 1 to step 7.

9. The Test System spins back the DUT to the original position.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- DL IP data usage: Total number of bytes transferred in the DL during the measurement time.

- UL IP data usage: Total number of bytes transferred in the UL during the measurement time.

5.4.6.2 Virtual Scene Loading

Identifier: *DDP/VR/002*

Title: Virtual Scene Loading

Objective: Measure the network resources consumed by the DUT using a HSRA while moving horizontally from the initial observation point under the user control.

.

Applicability:

(ICSG_ProductType = Mobile device) AND (ICSG_UseCases includes VR)

Initial Conditions:

- DUT is in [DUT-READY] mode.

Steps:

1. The Test System calls the Reference App API to execute the action 6.1 Select a virtual experience.

2. The Test System waits until the target object is recognized.

3. The Test System spins up the DUT a random number of degrees between 10 and 50.

4. The Test System waits until the target object is recognized.

5. The Test System commands the reference App to move horizontally (walking speed, 4 km/h) during 20 seconds in order to change the scene.

6. The Test System measures the network resources consumed by the DUT during step 5 execution.

7. The Test System spins back the DUT to the original position.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- DL IP data usage: Total number of bytes transferred in the DL during the measurement time.

- UL IP data usage: Total number of bytes transferred in the UL during the measurement time.

5.4.7 Augmented Reality

5.4.7.1 Load augmentation layer on a physical marker

Identifier: *DDP/AR/001*

Title: Load augmentation layer on a physical marker

Objective: Measure the network resources consumed by the DUT using an ARRA to render a virtual layer on top of a moving physical marker.

Applicability:

(ICSG_ProductType = Mobile device) AND (ICSG_UseCases includes AR)

Initial Conditions:

- DUT is in [DUT-READY] mode.

Steps:

1. The Test System calls the Reference App API to execute the action 7.1 Load augmentation layer on a physical marker.

2. The Test System measures the network resources consumed until the App displays a virtual layer on top of the physical marker.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- DL IP data usage: Total number of bytes transferred in the DL during the measurement time.

- UL IP data usage: Total number of bytes transferred in the UL during the measurement time.

5.4.7.2 Load Augmentation Layer at Location

Identifier: *DDP/AR/002*

Title: Load Augmentation Layer at location

Objective: Measure the network resources consumed by the DUT using an ARRA to render a virtual layer at a specific location.

Applicability:

(ICSG_ProductType = Mobile device) AND (ICSG_UseCases includes AR)

Initial Conditions:

- DUT is in [DUT-READY] mode.

Steps:

1. The Test System calls the Reference App API to execute the action 7.2 Load augmentation layer at a specific location.

2. The Test System measures the network resources consumed by the DUT until the App displays a virtual layer at the location specified.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- DL IP data usage: Total number of bytes transferred in the DL during the measurement time.

- UL IP data usage: Total number of bytes transferred in the UL during the measurement time.

5.4.7.3 Augmented reality session

Identifier: *DDP/AR/003*

Title: Augmented reality session

Objective: Measure the network resources consumed by the DUT using an ARRA during an augmented reality session.

Applicability:

(ICSG_ProductType = Mobile device) AND (ICSG_UseCases includes AR)

Initial Conditions:

- DUT is in [DUT-READY] mode.

Steps:

1. The Test System calls the Reference App API to execute the action 7.1 Load augmentation layer on a physical marker.
2. The Test System spins (in one of the three axis) the DUT 15 degrees, while the physical marker remains in the same position.
3. The Test Systems wait for 5 seconds
4. The Test System measures the network resources consumption in steps 2 and 3, and whether the reference App keeps showing the virtual layer on top of the physical marker.
5. The Test System spins in the same axis the DUT 30 degrees in the opposite direction, while the physical marker remains in the same position.
6. The Test Systems wait for 5 seconds
7. The Test System measures the network resources consumption in steps 5 and 6 and whether the reference App keeps showing the virtual layer on top of the physical virtual.
8. The Test System spins the DUT back to the original position.
9. The Test System spins back to the original position.
10. The Test System repeat steps 2 to 9 in the other two axis.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- DL IP data usage: Total number of bytes transferred in the DL during the measurement time.
- UL IP data usage: Total number of bytes transferred in the UL during the measurement time.

5.4.8 Gaming

5.4.8.1 Start Game session

Identifier: *DDP/GA/001*

Title: Start game session

Objective: Measure the network resources consumed by the DUT using a GARA while starting a game session.

Applicability:

(ICSG_ProductType = Mobile device) AND (ICSG_UseCases includes GA)

Initial Conditions:

- DUT is in [DUT-READY] mode.

- Reference App options are configured to their default values.

- Any reference App screen saving option is disabled.

- Reference App resolution is configured to maximum resolution available.

- Reference App Music and sound effects are configured to be ON.

- No energy saving option is enabled in the Reference App.

Steps:

1. The Test System calls the Reference App API to execute the action 10.1: Start game session.

2. The Test System measures the network resources consumed by the DUT while the game session is being started.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- DL IP data usage: Total number of bytes transferred in the DL during the measurement time.

- UL IP data usage: Total number of bytes transferred in the UL during the measurement time.

5.4.8.2 Short Game session

Identifier: *DDP/GA/002*

Title: Short Game session

Objective: Measure the network resources consumed by the DUT using a GARA while playing a short game session.

Applicability:

(ICSG_ProductType = Mobile device) AND (ICSG_UseCases includes LS)

Initial Conditions:

- DUT is in [DUT-READY] mode.

- Reference App options are configured to their default values.

- Any reference App screen saving option is disabled.

- Reference App resolution is configured to maximum resolution available.

- Reference App Music and sound effects are configured to be ON.

- No energy saving option is enabled in the reference App.

Steps:

1. The Test System calls the Reference App API to execute the action 7.2: Short game session.

2. The Test System measures the network resources consumed while the game session is being played.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- DL IP data usage: Total number of bytes transferred in the DL during the measurement time.

- UL IP data usage: Total number of bytes transferred in the UL during the measurement time.

5.4.8.3 Long Game session

Identifier: *DDP/GA/003*

Title: Long Game session

Objective: Measure the network resources consumed by the DUT using a GARA while playing a long game session.

Applicability:

(ICSG_ProductType = Mobile device) AND (ICSG_UseCases includes LS)

Initial Conditions:

- DUT is in [DUT-READY] mode.

- Reference App options are configured to their default values.

- Any reference App screen saving option is disabled.

- Reference App resolution is configured to maximum resolution available.

- Reference App Music and sound effects are configured to be ON.

- No energy saving option is enabled in the reference App.

Steps:

1. The Test System calls the Reference App API to execute the action 7.3: Long game session.

2. The Test System measures the network resources consumed while the game session is being played.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- DL IP data usage: Total number of bytes transferred in the DL during the measurement time.

- UL IP data usage: Total number of bytes transferred in the UL during the measurement time.

6 IoT devices

6.1   IoT devices Energy Consumption (IEC)

6.1.1 Common

The tests cases in this section apply to all Use Cases.

6.1.1.1 IUT in idle mode

Identifier: IEC*/CO/001*

Title: IUT in idle mode

Objective: Measure the energy that is consumed by the IUT when it is in idle mode.

Applicability:

(ICSG_ProductType = IoT device) AND ICSDI_IdleMode

Initial Conditions:

IUT is in [IUT STARTED] mode.

Steps:

1. The Test System measures the current consumption during 2 minutes, being the IUT in idle mode.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- Current consumption: Record current samples during the measurement time and calculate the following values:
    - Average current consumption.
    - Standard deviation

Item	Description	Status	Support	Mnemonic
1	Support of Playing received video	O		ICSDI_ReceiveVideo
2	Support of Video transmission	O		ICSDI_TransmitVideo
3	Support of Playing Received audio	O		ICSDI_ReceiveAudio
4	Support of Audio transmission	O		ICSDI_TransmitAudio
5	Support of Idle mode	O		ICSDI_IdleMode

6	Support of Audio transmission without Video	C.01		ICSDI_TransmitAudioWithoutVideo
7	Support of Playing received Audio without Video	C.02		ICSDI_ReceiveAudioWithoutVideo
8	Device is connected to a Battery	O		ICSDI_Battery

C.01   *IF A.4/4 THEN O ELSE N/A*
C.02   *IF A.4/3 THEN O ELSE N/A*

6.1.2 ES Emergency Services

6.1.2.1 Send Video streaming

Identifier: I*EC/ES/001*

Title: Send Video Streaming

Objective: Measure the energy that is consumed by an IUT while executing the feature Send Video Streaming from the Emergency Services use case.

Applicability:

(ICSG_ProductType = IoT device) AND (ICSG_UseCases includes ES) AND ICSDI_TransmitVideo

Initial Conditions:

IUT is in [IUT STARTED] mode.

Steps:

1. The Test System commands the IUT by the Control Interface to perform the feature 'Send live video streaming'.

2. After ten seconds, the Test System measures the current consumed for 2 minutes.

3. The Test System commands the IUT by the Control Interface to perform the feature 'Stop sending stream live video'.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- Current consumption: Record current samples during the measurement time and calculate the following values:
  - o Average current consumption.
  - o Standard deviation

6.1.2.2 Send audio streaming

Identifier: I*EC/ES/002*

Title: Send Audio Streaming

Objective: Measure the energy that is consumed by an IUT while executing the feature Send Audio Streaming from the Emergency Services use case.

Applicability:

(ICSG_ProductType = IoT device) AND (ICSG_UseCases includes ES) AND ICSDI_TransmitAudioWithoutVideo

Initial Conditions:

IUT is in [IUT STARTED] mode.

Steps:

1. The Test System commands the IUT by the Control Interface to perform the feature 'Send live audio streaming.

2. After ten seconds, the Test System measures the current consumed for 2 minutes.

3. The Test System commands the IUT by the Control Interface to perform the feature 'Stop streaming live audio.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- Current consumption: Record current samples during the measurement time and calculate the following values:
    - Average current consumption.
    - Standard deviation

6.1.2.3 Receive Video streaming

Identifier: I*EC/ES/003*

Title: Receive Video Streaming

Objective: Measure the energy that is consumed by an IUT while executing the feature Receive Video Streaming from the Emergency Services use case.

Applicability:

(ICSG_ProductType = IoT device) AND (ICSG_UseCases includes ES) AND ICSDI_ReceiveVideo

Initial Conditions:

IUT is in [IUT STARTED] mode.

Steps:

1. The Test System commands the IUT by the Control Interface to perform the feature 'Receive live video streaming'.

2. After ten seconds, the Test System measures the current consumed for 2 minutes.

3. The Test System commands the IUT by the Control Interface to perform the feature 'Stop receiving live video'.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- Current consumption: Record current samples during the measurement time and calculate the following values:
  - o Average current consumption.
  - o Standard deviation

6.1.2.4 Receive Audio streaming

Identifier: I*EC/ES/004*

Title: Receive Audio Streaming

Objective: Measure the energy that is consumed by an IUT while executing the feature Receive Audio Streaming from the Emergency Services use case.

Applicability:

(ICSG_ProductType = IoT device) AND (ICSG_UseCases includes ES) AND ICSDI_ReceiveAudioWithoutVideo

Initial Conditions:

IUT is in [IUT STARTED] mode.

Steps:

1. The Test System commands the IUT by the Control Interface to perform the feature 'Receive live audio Streaming.

2. After ten seconds, the Test System measures the current consumed for 2 minutes.

3. The Test System commands the IUT by the Control Interface to perform the feature 'Stop streaming live audio'.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- Current consumption: Record current samples during the measurement time and calculate the following values:
  - o Average current consumption.
  - o Standard deviation

6.2   IoT devices Data Performance (IDP)

6.2.1   Common

The tests cases in this section apply to all Use Cases.

6.2.1.1   IUT in idle mode

Identifier: IDP*/CO/001*

Title: IUT in idle mode

Objective: Measure the IUT data performance when it is in idle mode.

Applicability:

(ICSG_ProductType = IoT device) AND ICSDI_IdleMode

Initial Conditions:

IUT is in [IUT STARTED] mode.

Steps:

1. The Test System measures the data performance of the IUT in Idle mode during 20 minutes (as defined in the measurements section).

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- DL IP data usage: Total number of bytes transferred in the DL during the measurement time.

- UL IP data usage: Total number of bytes transferred in the UL during the measurement time.

6.2.2   ES Emergency Services

6.2.2.1   Send Video streaming

Identifier: I*DP/ES/001*

Title: Send Video Streaming

Objective: Measure the IUT data performance while executing the feature Send Video Streaming from the Emergency Services use case.

Applicability:

(ICSG_ProductType = IoT device) AND (ICSG_UseCases includes ES) AND ICSDI_TransmitVideo

Initial Conditions:

IUT is in [IUT STARTED] mode.

Steps:

1. The Test System commands the IUT by the Control Interface to perform the feature 'Send Stream live video'.

2. After ten seconds, the Test System measures the data performance of the IUT for 2 minutes.

3. The Test System commands the IUT by the Control Interface to perform the feature 'Stop sending stream live video'.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- DL IP data usage: Total number of bytes transferred in the DL during the measurement time.

- UL IP data usage: Total number of bytes transferred in the UL during the measurement time.

6.2.2.2 Send Audio streaming

Identifier: I*DP/ES/002*

Title: Send Audio Streaming

Objective: Measure the IUT data performance while executing the feature Send Audio Streaming from the Emergency Services use case.

Applicability:

(ICSG_ProductType = IoT device) AND (ICSG_UseCases includes ES) AND ICSDI_TransmitAudio

Initial Conditions:

IUT is in [IUT STARTED] mode.

Steps:

1. The Test System commands the IUT by the Control Interface to perform the feature 'Send streaming live audio.

2. After ten seconds, the Test measures the data performance of the IUT for 2 minutes.

3. The Test System commands the IUT by the Control Interface to perform the feature 'Stop streaming live audio.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- DL IP data usage: Total number of bytes transferred in the DL during the measurement time.

- UL IP data usage: Total number of bytes transferred in the UL during the measurement time.

6.2.2.3 Receive Video streaming

Identifier: I*DP/ES/003*

Title: Receive Video Streaming

Objective: Measure the IUT data performance while executing the feature Receive Video Streaming from the Emergency Services use case.

Applicability:

(ICSG_ProductType = IoT device) AND (ICSG_UseCases includes ES) AND ICSDI_ReceiveVideo

Initial Conditions:

IUT is in [IUT STARTED] mode.

Steps:

1. The Test System commands the IUT by the Control Interface to perform the feature 'Receive live video streaming'.
2. After ten seconds, the Test System measures the data performance of the IUT for 2 minutes.
3. The Test System commands the IUT by the Control Interface to perform the feature 'Stop receiving live video'.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- DL IP data usage: Total number of bytes transferred in the DL during the measurement time.

- UL IP data usage: Total number of bytes transferred in the UL during the measurement time.

6.2.2.4 Receive Audio streaming

Identifier: I*DP/ES/004*

Title: Receive Audio Streaming

Objective: Measure the IUT data performance while executing the feature Receive Audio Streaming from the Emergency Services use case.

Applicability:

(ICSG_ProductType = IoT device) AND (ICSG_UseCases includes ES) AND ICSDI_ReceiveAudio

Initial Conditions:

IUT is in [IUT STARTED] mode.

Steps:

1. The Test System commands the IUT by the Control Interface to perform the feature 'Stream live audio.

2. After ten seconds, the Test System measures the data performance of the IUT for 2 minutes.

3. The Test System commands the IUT by the Control Interface to perform the feature 'Stop streaming live audio'.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- DL IP data usage: Total number of bytes transferred in the DL during the measurement time.

- UL IP data usage: Total number of bytes transferred in the UL during the measurement time.

6.3   IoT Devices Reliability (IDR)

6.3.1 Common

The tests cases in this section apply to all Use Cases.

6.3.1.1 Network Connection

Identifier: IDR*/CO/001*

Title: Network Connection

Objective: Measure the IUT reliability KPIs when connecting to the network.

Applicability:

(ICSG_ProductType = IoT device)

Initial Conditions:

IUT is in [IUT-OFF] mode.

Steps:

1. The IUT is switched ON

2. The Test System establishes a data path with the IUT.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- Network connection: Establishment of network connection between the Test System and the IuT.

6.3.2 ES Emergency Services

6.3.2.1 Send video streaming

Identifier: IDR*/ES/001*

Title: Send video streaming

Objective: Measure the IUT reliability KPIs while executing the feature Send Video Streaming from the Emergency Services use case.

Applicability:

(ICSG_ProductType = IoT device) AND (ICSG_UseCases includes ES) AND ICSDI_TransmitVideo

Initial Conditions:

IUT is in [IUT STARTED] mode.

Steps:

1. The Test System commands the IUT by the Control Interface to perform the feature 'Send live video streaming'.

2. The Test System measures the number and duration of re-buffering occurrences for 2 minutes.

3. The Test System commands the IUT by the Control Interface to perform the feature 'Stop sending stream live video'.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- Stream Availability: Probability that stream transmission starts (it starts being received at the other side).

- Stream Cut-off: Probability that successfully started stream reproduction is ended by a cause other than the intentional termination by the user.

- Video resolution: Used frame resolution.

6.3.2.2 Send audio streaming

Identifier: IDR*/ES/002*

Title: Send Audio Streaming

Objective: Measure the IUT reliability KPIs while executing the feature Send Audio Streaming from the Emergency Services use case.

Applicability:

(ICSG_ProductType = IoT device) AND (ICSG_UseCases includes ES) AND ICSDI_TransmitAudio

Initial Conditions:

IUT is in [IUT STARTED] mode.

Steps:

1. The Test System commands the IUT by the Control Interface to perform the feature 'Send live audio streaming.

2. The Test System measures the number and duration of re-buffering occurrences for 2 minutes.

3. The Test System commands the IUT by the Control Interface to perform the feature 'Stop streaming live audio.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- Stream Availability: Probability that stream transmission starts (it starts being received at the other side).

- Stream Cut-off: Probability that successfully started audio stream reproduction is ended by a cause other than the intentional termination by the user.

6.3.2.3 Receive video streaming

Identifier: IDR*/ES/003*

Title: Receive Video Streaming

Objective: Measure the IUT reliability KPIs while executing the feature Receive Video Streaming from the Emergency Services use case.

Applicability:

(ICSG_ProductType = IoT device) AND (ICSG_UseCases includes ES) AND ICSDI_ReceiveVideo

Initial Conditions:

IUT is in [IUT STARTED] mode.

Steps:

1. The Test System commands the IUT by the Control Interface to perform the feature 'Receive live video streaming'.

2. The Test System measures the number and duration of re-buffering occurrences for 2 minutes.

3. The Test System commands the IUT by the Control Interface to perform the feature 'Stop receiving live video'.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- Stream Availability: Probability that stream reproduction starts at the IoT side.

- Stream Cut-off: Probability that successfully started stream reproduction is ended by a cause other than the intentional termination by the user.

- Video resolution: Used frame resolution.

6.3.2.4 Receive audio streaming

Identifier: IDR*/ES/004*

Title: Receive audio streaming

Objective: Measure the IUT reliability KPIs while executing the feature Receive Audio Streaming from the Emergency Services use case.

Applicability:

(ICSG_ProductType = IoT device) AND (ICSG_UseCases includes ES) AND ICSDI_ReceiveAudio

Initial Conditions:

IUT is in [IUT STARTED] mode.

Steps:

1. The Test System commands the IUT by the Control Interface to perform the feature 'Receive live audio Streaming.

2. The Test System measures the number and duration of re-buffering occurrences for 2 minutes.

3. The Test System commands the IUT by the Control Interface to perform the feature 'Stop streaming live audio'.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- Stream Availability: Probability that stream reproduction starts at the IoT side.

- Stream Cut-off: Probability that successfully started audio stream reproduction is ended by a cause other than the intentional termination by the user.

6.3.2.5 Power failure when sending video streaming

Identifier: IDR*/ES/005*

Title: Power failure when sending video streaming

Objective: Measure the IUT reliability KPIs when there is a power failure while executing the feature Send Video Streaming from the Emergency Services use case.

Applicability:

(ICSG_ProductType = IoT device) AND (ICSG_UseCases includes ES) AND ICSDI_TransmitVideo AND (NOT ICSDI_Battery)

Initial Conditions:

IUT is in [IUT STARTED] mode.

Steps:

1. The Test System commands the IUT by the Control Interface to perform the feature 'Send live video streaming'.

2. After one minute, the Test System stops feeding the IoT devices by setting the DC power source in OFF state.

3. After one minute, the Test System sets the DC power source in ON state again according to the nominal power of the IUT.

4. The Test System commands the IUT by the Control Interface to perform the feature 'Send live video streaming'.

5. The Test System measures the number and duration of re-buffering occurrences for 20minutes.

6. The Test System commands the IUT by the Control Interface to perform the feature 'Stop sending stream live video'.

Postamble:

*   Execute the Postamble sequence (see section 2.5).

Measurements:

*   Stream Availability after power failure: Probability that stream transmission starts (it starts being received at the other side) after the power failure.

*   Stream Cut-off: Probability that successfully started stream reproduction after the power failure is ended by a cause other than the intentional termination by the user.

*   Video resolution: Used frame resolution.

*   Recovery time (s): The elapsed duration since the power source is ON again until the streaming is ongoing again.

6.3.2.6 Power failure when sending audio streaming

Identifier: IDR*/ES/006*

Title: Power failure when sending audio streaming

Objective: Measure the IUT reliability KPIs while executing the feature Send Audio Streaming from the Emergency Services use case.

Applicability:

(ICSG_ProductType = IoT device) AND (ICSG_UseCases includes ES) AND ICSDI_TransmitAudio AND (NOT ICSDI_Battery)

Initial Conditions:

IUT is in [IUT STARTED] mode.

Steps:

1. The Test System commands the IUT by the Control Interface to perform the feature 'Send live audio streaming.

2. After one minute, the Test System stops feeding the IoT devices by setting the DC power source in OFF state.

3. After one minute, the Test System sets the DC power source in ON state again according to the nominal power of the IUT.

4. The Test System commands the IUT by the Control Interface to perform the feature 'Send live audio streaming.

5. The Test System measures the number and duration of re-buffering occurrences for 2 minutes.

6. The Test System commands the IUT by the Control Interface to perform the feature 'Stop streaming live audio.

Postamble:

• Execute the Postamble sequence (see section 2.5).

Measurements:

• Stream Availability: Probability that stream transmission starts (it starts being received at the other side) after the power failure.

• Stream Cut-off: Probability that successfully started audio stream reproduction after the power failure is ended by a cause other than the intentional termination by the user.

• Recovery time (s): The elapsed duration since the power source is ON again until the streaming is ongoing again.

6.3.2.7 Power failure when receiving video streaming

Identifier: IDR*/ES/007*

Title: Power failure when receiving video streaming

Objective: Measure the IUT reliability KPIs while executing the feature Receive Video Streaming from the Emergency Services use case.

Applicability:

(ICSG_ProductType = IoT device) AND (ICSG_UseCases includes ES) AND ICSDI_ReceiveVideo AND (NOT ICSDI_Battery)

Initial Conditions:

IUT is in [IUT STARTED] mode.

Steps:

1. The Test System commands the IUT by the Control Interface to perform the feature 'Receive live video streaming'.

2. After one minute, the Test System stops feeding the IoT devices by setting the DC power source in OFF state.

3. After one minute, the Test System sets the DC power source in ON state again according to the nominal power of the IUT.

4. The Test System commands the IUT by the Control Interface to perform the feature 'Receive live video streaming'.

5. The Test System measures the number and duration of re-buffering occurrences for 2 minutes.

6. The Test System commands the IUT by the Control Interface to perform the feature 'Stop receiving live video'.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- Stream Availability: Probability that stream reproduction starts at the IoT side after the power failure.

- Stream Cut-off: Probability that successfully started stream reproduction after the power failure is ended by a cause other than the intentional termination by the user.

- Video resolution: Used frame resolution.

- Recovery time (s): The elapsed duration since the power source is ON again until the streaming is ongoing again.

6.3.2.8 Power failure when receiving audio streaming

Identifier: IDR*/ES/008*

Title: Power failure when receiving audio streaming

Objective: Measure the IUT reliability KPIs while executing the feature Receive Audio Streaming from the Emergency Services use case.

Applicability:

(ICSG_ProductType = IoT device) AND (ICSG_UseCases includes ES) AND ICSDI_ReceiveAudio AND (NOT ICSDI_Battery)

Initial Conditions:

IUT is in [IUT STARTED] mode.

Steps:

1. The Test System commands the IUT by the Control Interface to perform the feature 'Receive live audio Streaming.

2. After one minute, the Test System stops feeding the IoT devices by setting the DC power source in OFF state.

3. After one minute, the Test System sets the DC power source in ON state again according to the nominal power of the IUT.

4. The Test System commands the IUT by the Control Interface to perform the feature 'Receive live audio Streaming.

5. The Test System measures the number and duration of re-buffering occurrences for 2 minutes.

6. The Test System commands the IUT by the Control Interface to perform the feature 'Stop streaming live audio'.

Postamble:

- Execute the Postamble sequence (see section 2.5).

Measurements:

- Stream Availability: Probability that stream reproduction starts at the IoT side after the power failure.

- Stream Cut-off: Probability that successfully started audio stream reproduction after the power failure is ended by a cause other than the intentional termination by the user.

- Recovery time (s): The elapsed duration since the power source is ON again until the streaming is ongoing again.

7   Test cases applicability

The applicability of each individual test is identified in Table C.1.

The applicability of every test is formally expressed by the use of Boolean expressions that are based on parameters (ICS) included in section 9 of this document.

The columns in Table C.1 have the following meaning:

Test case column

The Test case column indicates the test case number for each test case as described in the Control Panel Service Framework test case specification for which the applicability is identified.

Description column

The Title column indicates the title of each test case as described in the Control Panel Service Framework test case specification for which the applicability is identified.

Release column

The Release column indicates the earliest release from which each test case is applicable, except if otherwise stated of an individual test case.

Status column

The following notations are used for the Status column:

A   applicable - the test is applicable.

O   optional – the capability may be supported or not.

N/A   not applicable – in the given context, the test case is not applicable.

Ci   conditional – the test is applicable ("A") or not ("N/A") depending on the support of other optional or conditional items. "i" is an integer identifying an unique conditional status expression which is defined immediately following the table. For nested conditional expressions, the syntax "IF ... THEN (IF ... THEN ... ELSE...) ELSE ..." is used to avoid ambiguities.

The conditional expressions are added in the last row of the table. These expressions may use ICS as defined in D2.2 Appendix 2. ICS/IXIT. The ICS items will be referred as A.n/m where A.n refers to the table in which the ICS is defined and m refers to the item of the table.

An example of expression interpretation is shown below.

Test case	Test case title	Status
AUE/CS/001	Non Interactive Playback	C01

The status (applicability) of test case 'AUE/CS/001' is defined by condition' C01'

C01   IF (A.1/1= Application) AND (A.1/3 includes CS) THEN A ELSE N/A

Where:

C01:   Condition to be used in the test cases to define applicability

A.1/1   Value of Item 1 of table A.1 defined in D2.2 Appendix 2. ICS/IXIT In this case, value of ICS 'ICSG_ProductType' (Table A.1, item 1)

A.1/3 includes CSCS is one of the values of ICS 'ICSG_UseCases' (table A.1, item 3). (ICSG_UseCases ICS status is Mn, meaning that several options may be supported.

If the value of the sub-expresion *(A.1/1= Application)* is TRUE AND the value of the sub-expression *(A.1/3 includes CS) is TRUE, the test case status is Applicable (A); In any other case, the status is Not-applicable (N/A).*

7.1   Application test cases

Table 9 – AUE Test cases applicability

Test case	Test case title	Status
AUE/CO/001	Open the App	CU08
AUE/CO/002	Menu Navigation	CU08
AUE/CS/001	Non Interactive Playback	CU01
AUE/CS/002	Play and Pause	CU020
AUE/CS/003	Stop and Replay	CU01
AUE/CS/004	Search and Seek	CU22
AUE/CS/005	Rewind	CU21
AUE/CS/006	Playlist Skip Forward and Backward	CU23
AUE/CS/007	Download content for offline playing	CU09
AUE/CS/008	Fast Forward	CU24
AUE/LS/001	Play Live Video from User	CU02
AUE/LS/002	Broadcast Live Video	CU02
AUE/SN/001	Picture Posting	CU10
AUE/SN/002	Video Posting	CU11
AUE/SN/003	Comment Posting	CU12
AUE/SN/004	File Posting	CU13

Test case	Test case title	Status
AUE/SN/005	Show Picture	CU14
AUE/SN/006	Play Video	CU15
AUE/SN/007	File Downloading	CU16
AUE/SN/008	Play Live Video from User	CU17
AUE/SN/009	Search Object	CU03
AUE/HS/001	Downloading files sequentially	CU04
AUE/HS/002	Uploading files sequentially	CU04
AUE/HS/003	Pause and Resume Download Transfer	CU04
AUE/HS/004	Pause and Resume Upload Transfer	CU04
AUE/VR/001	Virtual Experience Loading	CU05
AUE/VR/002	Virtual Scene Loading	CU05
AUE/AR/001	Load Augmentation Layer on Physical Marker	CU06
AUE/AR/002	Load Augmentation Layer at Location	CU06
AUE/GA/001	Start new game sessions	CU07
AUE/GA/002	Long game session	CU07
AUE/GA/003	Pause and Resume	CU18
AUE/GA/004	Start saved game session	CU19

CU01   IF (A.1/1 = Application) AND (A.1/3 includes CS) THEN **A** ELSE **N/A**
CU02   IF (A.1/1 = Application) AND (A.1/3 includes LS) THEN **A** ELSE **N/A**
CU03   IF (A.1/1 = Application) AND (A.1/3 includes SN) THEN **A** ELSE **N/A**
CU04   IF (A.1/1 = Application) AND (A.1/3 includes HS) THEN **A** ELSE **N/A**
CU05   IF (A.1/1 = Application) AND (A.1/3 includes VR) THEN **A** ELSE **N/A**
CU06   IF (A.1/1 = Application) AND (A.1/3 includes AR) THEN **A** ELSE **N/A**
CU07   IF (A.1/1 = Application) AND (A.1/3 includes GA) THEN **A** ELSE **N/A**
CU08   IF (A.1/1 = Application) AND A.2/1 THEN **A** ELSE **N/A**
CU09   IF (A.1/1 = Application) AND (A.1/3 includes CS) AND A.2/14 THEN **A** ELSE **N/A**
CU10   IF (A.1/1 = Application) AND (A.1/3 includes SN) AND A.2/17 THEN **A** ELSE **N/A**
CU11   IF (A.1/1 = Application) AND (A.1/3 includes SN) AND A.2/16 THEN **A** ELSE **N/A**
CU12   IF (A.1/1 = Application) AND (A.1/3 includes SN) AND A.2/15 THEN **A** ELSE **N/A**
CU13   IF (A.1/1 = Application) AND (A.1/3 includes SN) AND A.2/19 THEN **A** ELSE **N/A**
CU14   IF (A.1/1 = Application) AND (A.1/3 includes SN) AND A.2/20 THEN **A** ELSE **N/A**
CU15   IF (A.1/1 = Application) AND (A.1/3 includes SN) AND A.2/21 THEN **A** ELSE **N/A**
CU16   IF (A.1/1 = Application) AND (A.1/3 includes SN) AND A.2/17 THEN **A** ELSE **N/A**
CU17   IF (A.1/1 = Application) AND (A.1/3 includes SN) AND A.2/24 THEN **A** ELSE **N/A**
CU18   IF (A.1/1 = Application) AND (A.1/3 includes GA) AND A.2/26 THEN **A** ELSE **N/A**
CU19   IF (A.1/1 = Application) AND (A.1/3 includes GA) AND A.2/25 THEN **A** ELSE **N/A**
CU20   IF (A.1/1 = Application) AND (A.1/3 includes CS) AND A.2/11 THEN **A** ELSE **N/A**
CU21   IF (A.1/1 = Application) AND (A.1/3 includes CS) AND A.2/10 THEN **A** ELSE **N/A**
CU22   IF (A.1/1 = Application) AND (A.1/3 includes CS) AND A.2/27 THEN **A** ELSE **N/A**
CU23   IF (A.1/1 = Application) AND (A.1/3 includes CS) AND A.2/7 AND A.2/9 THEN **A** ELSE **N/A**
CU24   IF (A.1/1 = Application) AND (A.1/3 includes CS) AND A.2/8 THEN **A** ELSE **N/A**
Note: See example below for expression interpretation.

Table 10 – Applications Device Resources usage Test cases applicability

Test case	Description	Status
RES/CO/001	Device ON	A
RES/CO/002	Open the AUT	CD08
RES/CO/003	Background state	CD08
RES/CS/001	Non Interactive Playback	CD01
RES/CS/002	Play and Pause	CD20
RES/CS/003	Rewind	CD21
RES/CS/004	Download content for offline playing	CD09
RES/CS/005	Non interactive Playback with screen off	CD25
RES/CS/006	Fast Forward	CD27
RES/LS/001	Play Live Video from User	CD02
RES/LS/002	Broadcast Live Video	CD02
RES/LS/003	Broadcast Live Video with screen off	CD26
RES/SN/001	Picture Posting	CD10
RES/SN/002	Video Posting	CD11
RES/SN/003	File Posting	CD13
RES/SN/004	Show Picture	CD14
RES/SN/005	Play Video	CD15
RES/SN/006	File Downloading	CD16
RES/HS/001	Downloading files sequentially	CD04
RES/HS/002	Uploading files sequentially	CD04
RES/HS/003	Downloading several files simultaneously	CD04
RES/HS/004	Uploading several files simultaneously	CD04
RES/HS/005	Downloading a file with screen off	CD04
RES/HS/006	Uploading a file with screen off	CD04
RES/VR/001	Virtual Experience Loading	CD05
RES/VR/002	Virtual Scene Loading	CD05
RES/AR/001	Load Augmentation Layer on Physical Marker	CD06
RES/AR/002	Load Augmentation Layer at Location	CD06
RES/AR/003	Augmented reality Session	CD06
RES/GA/001	Start game session	CD07

Test case	Description	Status
RES/GA/002	Short game session	CD07
RES/GA/003	Long game session	CD07
CD01 IF (A.1/1= Application) AND (A.1/3 includes CS) THEN A ELSE N/A CD02 IF (A.1/1= Application) AND (A.1/3 includes LS) THEN A ELSE N/A CD03 IF (A.1/1= Application) AND (A.1/3 includes SN) THEN A ELSE N/A CD04 IF (A.1/1= Application) AND (A.1/3 includes HS) THEN A ELSE N/A CD05 IF (A.1/1= Application) AND (A.1/3 includes VR) THEN A ELSE N/A CD06 IF (A.1/1= Application) AND (A.1/3 includes AR) THEN A ELSE N/A CD07 IF (A.1/1= Application) AND (A.1/3 includes GA) THEN A ELSE N/A CD08 IF (A.1/1= Application) AND A.2/1 THEN A ELSE N/A CD09 IF (A.1/1= Application) AND (A.1/3 includes CS) AND A.2/14 THEN A ELSE N/A CD10 IF (A.1/1= Application) AND (A.1/3 includes SN) AND A.2/17 THEN A ELSE N/A CD11 IF (A.1/1= Application) AND (A.1/3 includes SN) AND A.2/16 THEN A ELSE N/A CD12 IF (A.1/1= Application) AND (A.1/3 includes SN) AND A.2/15 THEN A ELSE N/A CD13 IF (A.1/1= Application) AND (A.1/3 includes SN) AND A.2/19 THEN A ELSE N/A CD14 IF (A.1/1= Application) AND (A.1/3 includes SN) AND A.2/20 THEN A ELSE N/A CD15 IF (A.1/1= Application) AND (A.1/3 includes SN) AND A.2/21 THEN A ELSE N/A CD16 IF (A.1/1= Application) AND (A.1/3 includes SN) AND A.2/17 THEN A ELSE N/A CD17 IF (A.1/1= Application) AND (A.1/3 includes SN) AND A.2/24 THEN A ELSE N/A CD18 IF (A.1/1= Application) AND (A.1/3 includes GA) AND A.2/26 THEN A ELSE N/A CD19 IF (A.1/1= Application) AND (A.1/3 includes GA) AND A.2/25 THEN A ELSE N/A CD20 IF (A.1/1= Application) AND (A.1/3 includes CS) AND A.2/11 THEN A ELSE N/A CD21 IF (A.1/1= Application) AND (A.1/3 includes CS) AND A.2/10 THEN A ELSE N/A CD22 IF (A.1/1= Application) AND (A.1/3 includes CS) AND A.2/27 THEN A ELSE N/A CD23 IF (A.1/1= Application) AND (A.1/3 includes CS) AND A.2/7 AND A.2/9 THEN A ELSE N/A CD24 IF (A.1/1= Application) AND (A.1/3 includes CS) AND A.2/4 THEN A ELSE N/A CD25 IF (A.1/1= Application) AND (A.1/3 includes CS) AND A.2/28 THEN A ELSE N/A CD26 IF (A.1/1= Application) AND (A.1/3 includes LS) AND A.2/29 THEN A ELSE N/A CD27 IF (A.1/1= Application) AND (A.1/3 includes CS) AND A.2/8 THEN **A** ELSE N/A		

Table 11 – Applications Energy consumption Test cases applicability

Test case	Description	Status
AEC/CO/001	Device ON	A
AEC/CO/002	Open the AUT	CE08
AEC/CO/003	Background state	CE08
AEC/CS/001	Non Interactive Playback	CE01
AEC/CS/002	Play and Pause	CE20
AEC/CS/003	Rewind	CE21
AEC/CS/004	Download content for offline playing	CE09
AEC/CS/005	Non interactive Playback with screen off	CE25
AEC/CS/006	Fast Forward	CE27
AEC/LS/001	Play Live Video from User	CE02
AEC/LS/002	Broadcast Live Video	CE02
AEC/LS/003	Broadcast Live Video with screen off	CE26

Test case	Description	Status
AEC/SN/001	Picture Posting	CE10
AEC/SN/002	Video Posting	CE11
AEC/SN/003	File Posting	CE13
AEC/SN/004	Show Picture	CE14
AEC/SN/005	Play Video	CE15
AEC/SN/006	File Downloading	CE16
AEC/HS/001	Downloading files sequentially	CE04
AEC/HS/002	Uploading files sequentially	CE04
AEC/HS/003	Downloading several files simultaneously	CE04
AEC/HS/004	Uploading several files simultaneously	CE04
AEC/HS/005	Downloading a file with screen off	CE04
AEC/HS/006	Uploading a file with screen off	CE04
AEC/VR/001	Virtual Experience Loading	CE05
AEC/VR/002	Virtual Scene Loading	CE05
AEC/AR/001	Load Augmentation Layer on Physical Marker	CE06
AEC/AR/002	Load Augmentation Layer at Location	CE06
AEC/AR/003	Augmented reality Session	CE06
AEC/GA/001	Start game session	CE07
AEC/GA/002	Short game session	CE07
AEC/GA/003	Long game session	CE07

Test case	Description	Status
CE01	IF (A.1/1= Application) AND (A.1/3 includes CS) THEN **A** ELSE **N/A**	
CE02	IF (A.1/1= Application) AND (A.1/3 includes LS) THEN **A** ELSE **N/A**	
CE03	IF (A.1/1= Application) AND (A.1/3 includes SN) THEN **A** ELSE **N/A**	
CE04	IF (A.1/1= Application) AND (A.1/3 includes HS) THEN **A** ELSE **N/A**	
CE05	IF (A.1/1= Application) AND (A.1/3 includes VR) THEN **A** ELSE **N/A**	
CE06	IF (A.1/1= Application) AND (A.1/3 includes AR) THEN **A** ELSE **N/A**	
CE07	IF (A.1/1= Application) AND (A.1/3 includes GA) THEN **A** ELSE **N/A**	
CE08	IF (A.1/1= Application) AND A.2/1 THEN A ELSE **N/A**	
CE09	IF (A.1/1= Application) AND (A.1/3 includes CS) AND A.2/14 THEN **A** ELSE **N/A**	
CE10	IF (A.1/1= Application) AND (A.1/3 includes SN) AND A.2/17 THEN **A** ELSE **N/A**	
CE11	IF (A.1/1= Application) AND (A.1/3 includes SN) AND A.2/16 THEN **A** ELSE **N/A**	
CE12	IF (A.1/1= Application) AND (A.1/3 includes SN) AND A.2/15 THEN **A** ELSE **N/A**	
CE13	IF (A.1/1= Application) AND (A.1/3 includes SN) AND A.2/19 THEN **A** ELSE **N/A**	
CE14	IF (A.1/1= Application) AND (A.1/3 includes SN) AND A.2/20 THEN **A** ELSE **N/A**	
CE15	IF (A.1/1= Application) AND (A.1/3 includes SN) AND A.2/21 THEN **A** ELSE **N/A**	
CE16	IF (A.1/1= Application) AND (A.1/3 includes SN) AND A.2/17 THEN **A** ELSE **N/A**	
CE17	IF (A.1/1= Application) AND (A.1/3 includes SN) AND A.2/24 THEN **A** ELSE **N/A**	
CE18	IF (A.1/1= Application) AND (A.1/3 includes GA) AND A.2/26 THEN **A** ELSE **N/A**	
CE19	IF (A.1/1= Application) AND (A.1/3 includes GA) AND A.2/25 THEN **A** ELSE **N/A**	
CE20	IF (A.1/1= Application) AND (A.1/3 includes CS) AND A.2/11 THEN **A** ELSE **N/A**	
CE21	IF (A.1/1= Application) AND (A.1/3 includes CS) AND A.2/10 THEN **A** ELSE **N/A**	
CE22	IF (A.1/1= Application) AND (A.1/3 includes CS) AND A.2/27 THEN **A** ELSE **N/A**	
CE23	IF (A.1/1= Application) AND (A.1/3 includes CS) AND A.2/7 AND A.2/9 THEN **A** ELSE **N/A**	
CE24	IF (A.1/1= Application) AND (A.1/3 includes CS) AND A.2/4 THEN **A** ELSE **N/A**	
CE25	IF (A.1/1= Application) AND (A.1/3 includes CS) AND A.2/28 THEN **A** ELSE **N/A**	
CE26	IF (A.1/1= Application) AND (A.1/3 includes LS) AND A.2/29 THEN **A** ELSE **N/A**	
CE27	IF (A.1/1= Application) AND (A.1/3 includes CS) AND A.2/8 THEN **A** ELSE **N/A**	

Table 12 – Test cases applicability

Test case	Test case title	Status
REL/CO/001	Open the App	CR08
REL/CO/002	Menu Navigation	CR08
REL/CS/001	Non Interactive Playback	CR01
REL/CS/002	Play and Pause	CR020
REL/CS/003	Stop and Replay	CR01
REL/CS/004	Search and Seek	CR22
REL/CS/005	Rewind	CR21
REL/CS/006	Playlist Skip Forward and Backward	CR23
REL/CS/007	Download content for offline playing	CR09
REL/CS/008	Fast Forward	CR24
REL/LS/001	Play Live Video from User	CR02
REL/LS/002	Broadcast Live Video	CR02
REL/SN/001	Picture Posting	CR10
REL/SN/002	Video Posting	CR11

Test case	Test case title	Status
REL/SN/003	Comment Posting	CR12
REL/SN/004	File Posting	CR13
REL/SN/005	Show Picture	CR14
REL/SN/006	Play Video	CR15
REL/SN/007	File Downloading	CR16
REL/SN/008	Play Live Video from User	CR17
REL/SN/009	Search Object	CR03
REL/HS/001	Downloading files sequentially	CR04
REL/HS/002	Uploading files sequentially	CR04
REL/HS/003	Pause and Resume Download Transfer	CR04
REL/HS/004	Pause and Resume Upload Transfer	CR04
REL/VR/001	Virtual Experience Loading	CR05
REL/VR/002	Virtual Scene Loading	CR05
REL/AR/001	Load Augmentation Layer on Physical Marker	CR06
REL/AR/002	Load Augmentation Layer at Location	CR06
REL/GA/001	Start new game sessions	CR07
REL/GA/002	Long game session	CR07
REL/GA/003	Pause and Resume	CR18
REL/GA/004	Start saved game session	CR19

Test case	Test case title	Status
CR01	IF (A.1/1 = Application) AND (A.1/3 includes CS) THEN **A** ELSE **N/A**	
CR02	IF (A.1/1 = Application) AND (A.1/3 includes LS) THEN **A** ELSE **N/A**	
CR03	IF (A.1/1 = Application) AND (A.1/3 includes SN) THEN **A** ELSE **N/A**	
CR04	IF (A.1/1 = Application) AND (A.1/3 includes HS) THEN **A** ELSE **N/A**	
CR05	IF (A.1/1 = Application) AND (A.1/3 includes VR) THEN **A** ELSE **N/A**	
CR06	IF (A.1/1 = Application) AND (A.1/3 includes AR) THEN **A** ELSE **N/A**	
CR07	IF (A.1/1 = Application) AND (A.1/3 includes GA) THEN **A** ELSE **N/A**	
CR08	IF (A.1/1 = Application) AND A.2/1 THEN **A** ELSE **N/A**	
CR09	IF (A.1/1 = Application) AND (A.1/3 includes CS) AND A.2/14 THEN **A** ELSE **N/A**	
CR10	IF (A.1/1 = Application) AND (A.1/3 includes SN) AND A.2/17 THEN **A** ELSE **N/A**	
CR11	IF (A.1/1 = Application) AND (A.1/3 includes SN) AND A.2/16 THEN **A** ELSE **N/A**	
CR12	IF (A.1/1 = Application) AND (A.1/3 includes SN) AND A.2/15 THEN **A** ELSE **N/A**	
CR13	IF (A.1/1 = Application) AND (A.1/3 includes SN) AND A.2/19 THEN **A** ELSE **N/A**	
CR14	IF (A.1/1 = Application) AND (A.1/3 includes SN) AND A.2/20 THEN **A** ELSE **N/A**	
CR15	IF (A.1/1 = Application) AND (A.1/3 includes SN) AND A.2/21 THEN **A** ELSE **N/A**	
CR16	IF (A.1/1 = Application) AND (A.1/3 includes SN) AND A.2/17 THEN **A** ELSE **N/A**	
CR17	IF (A.1/1 = Application) AND (A.1/3 includes SN) AND A.2/24 THEN **A** ELSE **N/A**	
CR18	IF (A.1/1 = Application) AND (A.1/3 includes GA) AND A.2/26 THEN **A** ELSE **N/A**	
CR19	IF (A.1/1 = Application) AND (A.1/3 includes GA) AND A.2/25 THEN **A** ELSE **N/A**	
CR20	IF (A.1/1 = Application) AND (A.1/3 includes CS) AND A.2/11 THEN **A** ELSE **N/A**	
CR21	IF (A.1/1 = Application) AND (A.1/3 includes CS) AND A.2/10 THEN **A** ELSE **N/A**	
CR22	IF (A.1/1 = Application) AND (A.1/3 includes CS) AND A.2/27 THEN **A** ELSE **N/A**	
CR23	IF (A.1/1 = Application) AND (A.1/3 includes CS) AND A.2/7 AND A.2/9 THEN **A** ELSE **N/A**	
CR24	IF (A.1/1 = Application) AND (A.1/3 includes CS) AND A.2/8 THEN **A** ELSE **N/A**	
Note: See example below for expression interpretation.		

Table 13 – Test cases applicability

Test case	Test case title	Status
NWR/CO/001	Open the App	CN08
NWR/CO/002	Menu Navigation	CN08
NWR/CS/001	Non Interactive Playback	CN01
NWR/CS/002	Play and Pause	CN020
NWR/CS/003	Rewind	CN21
NWR/CS/004	Download content for offline playing	CN09
NWR/CS/005	Fast Forward	CN24
NWR/LS/001	Play Live Video from User	CN02
NWR/LS/002	Broadcast Live Video	CN02
NWR/SN/001	Picture Posting	CN10
NWR/SN/002	Video Posting	CN11
NWR/SN/003	Comment Posting	CN12
NWR/SN/004	File Posting	CN13
NWR/SN/005	Show Picture	CN14
NWR/SN/006	Play Video	CN15

Test case	Test case title	Status
NWR/SN/007	File Downloading	CN16
NWR/SN/008	Play Live Video from User	CN17
NWR/SN/009	Search Object	CN03
NWR/HS/001	Downloading files sequentially	CN04
NWR/HS/002	Uploading files sequentially	CN04
NWR/HS/003	Pause and Resume Download Transfer	CN04
NWR/HS/004	Pause and Resume Upload Transfer	CN04
NWR/VR/001	Virtual Experience Loading	CN05
NWR/VR/002	Virtual Scene Loading	CN05
NWR/AR/001	Load Augmentation Layer on Physical Marker	CN06
NWR/AR/002	Load Augmentation Layer at Location	CN06
NWR/GA/001	Start new game sessions	CN07
NWR/GA/002	Long game session	CN07
NWR/GA/003	Pause and Resume	CN18
NWR/GA/004	Start saved game session	CN19

CN01	IF (A.1/1 = Application) AND (A.1/3 includes CS) THEN **A** ELSE **N/A**
CN02	IF (A.1/1 = Application) AND (A.1/3 includes LS) THEN **A** ELSE **N/A**
CN03	IF (A.1/1 = Application) AND (A.1/3 includes SN) THEN **A** ELSE **N/A**
CN04	IF (A.1/1 = Application) AND (A.1/3 includes HS) THEN **A** ELSE **N/A**
CN05	IF (A.1/1 = Application) AND (A.1/3 includes VR) THEN **A** ELSE **N/A**
CN06	IF (A.1/1 = Application) AND (A.1/3 includes AR) THEN **A** ELSE **N/A**
CN07	IF (A.1/1 = Application) AND (A.1/3 includes GA) THEN **A** ELSE **N/A**
CN08	IF (A.1/1 = Application) AND A.2/1 THEN **A** ELSE **N/A**
CN09	IF (A.1/1 = Application) AND (A.1/3 includes CS) AND A.2/14 THEN **A** ELSE **N/A**
CN10	IF (A.1/1 = Application) AND (A.1/3 includes SN) AND A.2/17 THEN **A** ELSE **N/A**
CN11	IF (A.1/1 = Application) AND (A.1/3 includes SN) AND A.2/16 THEN **A** ELSE **N/A**
CN12	IF (A.1/1 = Application) AND (A.1/3 includes SN) AND A.2/15 THEN **A** ELSE **N/A**
CN13	IF (A.1/1 = Application) AND (A.1/3 includes SN) AND A.2/19 THEN **A** ELSE **N/A**
CN14	IF (A.1/1 = Application) AND (A.1/3 includes SN) AND A.2/20 THEN **A** ELSE **N/A**
CN15	IF (A.1/1 = Application) AND (A.1/3 includes SN) AND A.2/21 THEN **A** ELSE **N/A**
CN16	IF (A.1/1 = Application) AND (A.1/3 includes SN) AND A.2/17 THEN **A** ELSE **N/A**
CN17	IF (A.1/1 = Application) AND (A.1/3 includes SN) AND A.2/24 THEN **A** ELSE **N/A**
CN18	IF (A.1/1 = Application) AND (A.1/3 includes GA) AND A.2/26 THEN **A** ELSE **N/A**
CN19	IF (A.1/1 = Application) AND (A.1/3 includes GA) AND A.2/25 THEN **A** ELSE **N/A**
CN20	IF (A.1/1 = Application) AND (A.1/3 includes CS) AND A.2/11 THEN **A** ELSE **N/A**
CN21	IF (A.1/1 = Application) AND (A.1/3 includes CS) AND A.2/10 THEN **A** ELSE **N/A**
CN22	IF (A.1/1 = Application) AND (A.1/3 includes CS) AND A.2/27 THEN **A** ELSE **N/A**
CN23	IF (A.1/1 = Application) AND (A.1/3 includes CS) AND A.2/7 AND A.2/9 THEN **A** ELSE **N/A**
CN24	IF (A.1/1 = Application) AND (A.1/3 includes CS) AND A.2/8 THEN **A** ELSE **N/A**

Note: See example below for expression interpretation.

7.2   Mobile devices test cases

Table 14 – Test cases applicability

Test case	Description	Status
DRA/CO/001	Open the App	A
DRA/CO/002	Menu Navigation	A
DRA/CS/001	Non Interactive Playback	C01
DRA/CS/002	Play and Pause	C01
DRA/CS/003	Stop and Replay	C01
DRA/CS/004	Search and Seek	C01
DRA/CS/005	Rewind	C01
DRA/CS/006	Playlist Skip Forward and Backward	C01
DRA/CS/007	Download content for offline playing	A
DRA/CS/008	Fast Forward	C01
DRA/LS/001	Play Live Video from User	C01
DRA/LS/002	Broadcast Live Video	C02
DRA/SN/001	Picture Posting	A
DRA/SN/002	Video Posting	A
DRA/SN/003	Comment Posting	A
DRA/SN/004	File Posting	A
DRA/SN/005	Show Picture	A
DRA/SN/006	Play Video	C01
DRA/SN/007	File Downloading	A
DRA/SN/008	Play Live Video from User	C01
DRA/SN/009	Search Object	A
DRA/HS/001	Downloading files sequentially	A
DRA/HS/002	Uploading files sequentially	A
DRA/HS/003	Pause and Resume Download Transfer	A
DRA/HS/004	Pause and Resume Upload Transfer	A
DRA/VR/001	Virtual Experience Loading	C03
DRA/VR/002	Virtual Scene Loading	C03
DRA/AR/001	Load Augmentation Layer on Physical Marker	C04
DRA/AR/002	Load Augmentation Layer at Location	C04

Test case	Description	Status
DRA/GA/001	Start new game sessions	A
DRA/GA/002	Long Game session	A
DRA/GA/003	Pause and Resume	A
DRA/GA/004	Start saved game session	A
C01	IF (A.1/1= Mobile Device) AND (A.4/1) THEN A ELSE N/A	
C02	IF (A.1/1= Mobile Device) AND (A.4/2) THEN A ELSE N/A	
C03	IF (A.1/1= Mobile Device) AND (A.4/3) THEN A ELSE N/A	
C04	IF (A.1/1= Mobile Device) AND (A.4/4) THEN A ELSE N/A	

Table 15 – Mobile devices Energy consumption Test cases applicability

Test case	Description	Status
DEC/CO/001	Device On	A
DEC/CO/002	Device On with screen OFF	A
DEC/CO/003	Background state	A
DEC/CS/001	Non Interactive Playback	C01
DEC/CS/002	Play and Pause	C01
DEC/CS/003	Rewind	C01
DEC/CS/004	Download content for offline playing	C01
DEC/CS/005	Non interactive Playback with screen off	C01
DEC/CS/006	Fast Forward	C01
DEC/LS/001	Play Live Video from User	C02
DEC/LS/002	Broadcast Live Video	C02
DEC/LS/003	Broadcast Live Video with screen off	C02
DEC/SN/001	Picture Posting	C03
DEC/SN/002	Video Posting	C03
DEC/SN/003	File Posting	C03
DEC/SN/004	Show Picture	C03
DEC/SN/005	Play Video	C03
DEC/SN/006	File Downloading	C03
DEC/HS/001	Downloading files sequentially	C04
DEC/HS/002	Uploading files sequentially	C04
DEC/HS/003	Downloading several files simultaneously	C04
DEC/HS/004	Uploading several files simultaneously	C04

Test case	Description	Status
DEC/HS/005	Downloading a file with screen off	C04
DEC/HS/006	Uploading a file with screen off	C04
DEC/VR/001	Virtual Experience Loading	C05
DEC/VR/002	Virtual Scene Loading	C05
DEC/AR/001	Load Augmentation Layer on Physical Marker	C06
DEC/AR/002	Load Augmentation Layer at Location	C06
DEC/AR/003	Augmented reality Session	C06
DEC/GA/001	Start game session	C07
DEC/GA/002	Short game session	C07
DEC/GA/003	Long game session	C07
C01　　　IF (A.1/1= Mobile Device) AND (A.1/3 includes CS) AND A.3/1 THEN **A** ELSE **N/A** C02　　　IF (A.1/1= Mobile Device) AND (A.1/3 includes LS) AND A.3/2 THEN **A** ELSE **N/A** C03　　　IF (A.1/1= Mobile Device) AND (A.1/3 includes SN) THEN **A** ELSE **N/A** C04　　　IF (A.1/1= Mobile Device) AND (A.1/3 includes HS) THEN **A** ELSE **N/A** C05　　　IF (A.1/1= Mobile Device) AND (A.1/3 includes VR) THEN **A** ELSE **N/A** C06　　　IF (A.1/1= Mobile Device) AND (A.1/3 includes AR) THEN **A** ELSE **N/A** C07　　　IF (A.1/1= Mobile Device) AND (A.1/3 includes GA) THEN **A** ELSE **N/A**		

Table 16 – Mobile devices Radio Performance Test cases applicability

Test case	Description	Status
RFP/HS/001	Sensitivity	C01
RFP/HS/002	Adjacent Channel Selectivity	C01
C01　　　IF (A.1/1= Mobile Device) AND (A.4/1) THEN A ELSE N/A		

Table 17 – Mobile devices Data Performance Test cases applicability

Test case	Description	Status
DDP/CO/001	Device On	A
DDP/CS/001	Non Interactive Playback	C01
DDP/CS/002	Play and Pause	C01
DDP/CS/003	Rewind	C01
DDP/CS/004	Download content for offline playing	C01
DDP/CS/005	Fast Forward	C01

Test case	Description	Status
DDP/LS/001	Play Live Video from User	C02
DDP/LS/002	Broadcast Live Video	C02
DDP/LS/003	Broadcast Live Video with screen off	C02
DDP/SN/001	Picture Posting	C03
DDP/SN/002	Video Posting	C03
DDP/SN/003	File Posting	C03
DDP/SN/004	Show Picture	C03
DDP/SN/005	Play Video	C03
DDP/SN/006	File Downloading	C03
DDP/HS/001	Downloading files sequentially	C04
DDP/HS/002	Uploading files sequentially	C04
DDP/HS/003	Downloading several files simultaneously	C04
DDP/HS/004	Uploading several files simultaneously	C04
DDP/HS/005	Downloading a file with screen off	C04
DDP/HS/006	Uploading a file with screen off	C04
DDP/VR/001	Virtual Experience Loading	C05
DDP/VR/002	Virtual Scene Loading	C05
DDP/AR/001	Load Augmentation Layer on Physical Marker	C06
DDP/AR/002	Load Augmentation Layer at Location	C06
DDP/AR/003	Augmented reality Session	C06
DDP/GA/001	Start game session	C07
DDP/GA/002	Short game session	C07
DDP/GA/003	Long game session	C07

C01	IF (A.1/1= Mobile Device) AND (A.1/3 includes CS) AND A.3/1 THEN **A** ELSE **N/A**
C02	IF (A.1/1= Mobile Device) AND (A.1/3 includes LS) AND A.3/2 THEN **A** ELSE **N/A**
C03	IF (A.1/1= Mobile Device) AND (A.1/3 includes SN) THEN **A** ELSE **N/A**
C04	IF (A.1/1= Mobile Device) AND (A.1/3 includes HS) THEN **A** ELSE **N/A**
C05	IF (A.1/1= Mobile Device) AND (A.1/3 includes VR) THEN **A** ELSE **N/A**
C06	IF (A.1/1= Mobile Device) AND (A.1/3 includes AR) THEN **A** ELSE **N/A**
C07	IF (A.1/1= Mobile Device) AND (A.1/3 includes GA) THEN **A** ELSE **N/A**

7.3 IoT devices test cases

Table 18 – IoT devices Energy Consumption Test cases applicability

Test case	Description	Status
IEC/CO/001	IUT in idle mode	C01
IEC/ES/001	Send video streaming	C02
IEC/ES/002	Send Audio streaming	C03
IEC/ES/003	Receive video streaming	C04
IEC/ES/004	Receive audio streaming	C05

C01	IF (A.1/1= IoT device) AND (A.1/3 includes ES) AND A.4/5 THEN **A** ELSE **N/A**
C02	IF (A.1/1= IoT device) AND (A.1/3 includes ES) AND A.4/2 THEN **A** ELSE **N/A**
C03	IF (A.1/1= IoT device) AND (A.1/3 includes ES) AND A.4/6 THEN **A** ELSE **N/A**
C04	IF (A.1/1= IoT device) AND (A.1/3 includes ES) AND A.4/1 THEN **A** ELSE **N/A**
C05	IF (A.1/1= IoT device) AND (A.1/3 includes ES) AND A.4/7 THEN **A** ELSE **N/A**

Item	Description	Status	Support	Mnemonic
1	Support of Playing received video	O		ICSDI_ReceiveVideo
2	Support of Video transmission	O		ICSDI_TransmitVideo
3	Support of Playing Received audio	O		ICSDI_PlayAudio
4	Support of Audio transmission	O		ICSDI_RecordAudio
5	Support of Idle mode	O		ICSDI_IdleMode
6	Support of Audio transmission without Video	C.01		ICSDI_RecordAudioWithoutVideo
7	Support of Playing received Audio without Video	C.02		ICSDI_PlayAudioWithoutVideo
8	Device is connected to a Battery	O		ICSDI_Battery

C.01   IF A.4/4 THEN O ELSE N/A
C.02   IF A.4/3 THEN O ELSE N/A

Table 19 – IoT devices Data Performance Test cases applicability

Test case	Description	Status
IDP/CO/001	IUT in idle mode	C01
IDP/ES/001	Send video streaming	C02
IDP/ES/002	Send Audio streaming	C03
IDP/ES/003	Receive video streaming	C04
IDP/ES/004	Receive audio streaming	C05
C01	IF (A.1/1= IoT device) AND (A.1/3 includes ES) AND A.4/5 THEN **A** ELSE **N/A**	
C02	IF (A.1/1= IoT device) AND (A.1/3 includes ES) AND A.4/1 THEN **A** ELSE **N/A**	
C03	IF (A.1/1= IoT device) AND (A.1/3 includes ES) AND A.4/6 THEN **A** ELSE **N/A**	
C04	IF (A.1/1= IoT device) AND (A.1/3 includes ES) AND A.4/7 THEN **A** ELSE **N/A**	
C05	IF (A.1/1= IoT device) AND (A.1/3 includes ES) AND A.4/3 THEN **A** ELSE **N/A**	

Table 20 – IoT devices Reliability Test cases applicability

Test case	Description	Status
IDR/CO/001	Network connection	C06
IDR/ES/001	Send video streaming	C02
IDR/ES/002	Send Audio streaming	C03
IDR/ES/003	Receive video streaming	C04
IDR/ES/004	Receive audio streaming	C05
IDR/ES/005	Power failure when sending video streaming	C07
IDR/ES/006	Power failure when sending Audio streaming	C08
IDR/ES/007	Power failure when receiving video streaming	C09
IDR/ES/008	Power failure when receiving audio streaming	C10
C02	IF (A.1/1= IoT device) AND (A.1/3 includes ES) AND A.4/1 THEN **A** ELSE **N/A**	
C03	IF (A.1/1= IoT device) AND (A.1/3 includes ES) AND A.4/6 THEN **A** ELSE **N/A**	
C04	IF (A.1/1= IoT device) AND (A.1/3 includes ES) AND A.4/7 THEN **A** ELSE **N/A**	
C05	IF (A.1/1= IoT device) AND (A.1/3 includes ES) AND A.4/3 THEN **A** ELSE **N/A**	
C06	IF (A.1/1= IoT device) THEN **A** ELSE **N/A**	
C07	IF (A.1/1= IoT device) AND (A.1/3 includes ES) AND A.4/1 AND (NOT A.4/8) THEN **A** ELSE **N/A**	
C08	IF (A.1/1= IoT device) AND (A.1/3 includes ES) AND A.4/6 AND (NOT A.4/8) THEN **A** ELSE **N/A**	
C09	IF (A.1/1= IoT device) AND (A.1/3 includes ES) AND A.4/7 AND (NOT A.4/8) THEN **A** ELSE **N/A**	
C10	IF (A.1/1= IoT device) AND (A.1/3 includes ES) AND A.4/3 AND (NOT A.4/8) THEN **A** ELSE **N/A**	

8 Key Performance Indicators

This chapter summarizes the Key Performance Indicators that will be obtained based on the measurements obtained by the execution of the test cases and each test case repetition.

8.1 Application test cases

Table 21 – Application User Experience (AUE) Key Performance Indicators

Measurements	Use Cases	Type	Unit	Summarization	KPI
Access Time	All	Unsigned Integer	n/a	Average, Deviation, CDF	App Access Time
Accessibility	All	Boolean	n/a	Ratio	App Accessibility
Availability	All	Boolean	n/a	Ratio	App Availability
Cut-off	CO, CS, LS, SN, VR, AR, GA	Boolean	n/a	Ratio	App Availability
Time to load first media frame	CS, LS SN, GA	Unsigned Integer	s	Average, Deviation, CDF	Content Load Time
Time to load after resuming	CS, LS SN, GA				
Time to load the virtual world	VR				
Time to load the virtual scene	VR				
Time to load augmentation	AR				
Response Time	VR, AR, GA	Unsigned Integer	S	Average, Deviation, CDF	Response Time
Playback	CS, LS, SN	Boolean	n/a	Ratio	Feature Availability
Pause Operation	CS, SN, HS, GA				
Resume Operation	CS, SN, HS, GA				
Stop Operation	CS, LS, SN				
Rewind Operation	CS				
Fast Forward Operation	CS				
Search Operation	CS, LS, SN				
Seek Operation	CS				
Skip Forward Operation	CS				
Skip Backward Operation	CS				

{Picture, Video, Comment, File} Transfer	CS, SN, HS				
Load Augmentation Layer Operation	AR				
Clear Augmentation Layer Operation	AR				
Content Stall	CS, LS, SN, VR, GA	Vector of Unsigned Integer	s	Count, Index (1), CDF	Content Stall
Search Time	CS, LS, SN	Unsigned Integer	s	Average, Deviation, CDF	Content Search Time
{Picture, Video, File} Download Time	CS, SN, HS	Unsigned Integer	s	Average, Deviation, CDF	Content Download Throughput
{Picture, Video, File} Upload Time	CS, SN, HS	Unsigned Integer	s	Average, Deviation, CDF	Content Upload Throughput
Video Resolution	CS, SN, LS, AR, VR, GA	Vector of Nominal	n/a	Mode, CDF	Content Resolution

Table 22 – Application Device Resource Usage (RES) Key Performance Indicators

Measurements	Use Cases	Type	Unit	Summarization	KPI
Memory Usage	All	Unsigned Integer	Byte, %	Average, Deviation, CDF	Use of memory
CPU Usage	All	Unsigned Integer	%	Average, Deviation, CDF	Use of CPU
GPU Usage	All	Unsigned Integer	%	Average, Deviation, CDF	Use of GPU

Table 23 – Application Energy Consumption (AEC) Key Performance Indicators

Measurements	Use Cases	Type	Unit	Summarization	KPI
Current consumption	All	Unsigned Integer	mA	Average, Deviation, Skewness, Kurtosis	App Consumption

Table 24 – Application Reliability (REL) Key Performance Indicators

Measurements	Use Cases	Type	Unit	Summarization	KPI
Accessibility	CO	Boolean	n/a	Ratio	App availability
Cut-off	CO, CS, LS, SN, VR, AR, GA	Boolean	n/a	Ratio	
Accessibility	CO	Boolean	n/a	Ratio	

Cut-off	CO, CS, LS, SN, VR, AR, GA	Boolean	n/a	Ratio	App Autorecovery after fail
Accessibility	CO	Boolean	n/a	Ratio	App Degradation
Cut-off	CO, CS, LS, SN, VR, AR, GA	Boolean	n/a	Ratio	
Availability	All	Boolean	n/a	Ratio	Feature availability
Cut-off	All	Boolean	n/a	Ratio	
Operation	CO, CS, LS, SN, VR, AR, GA	Boolean	n/a	Ratio	
Availability	All	Boolean	n/a	Ratio	Feature Autorecovery after fail
Cut-off	All	Boolean	n/a	Ratio	
Operation	CO, CS, LS, SN, VR, AR, GA	Boolean	n/a	Ratio	
Access Time	CO	Unsigned Integer	s	Average, Deviation, CDF	Feature Degradation
Time to load first media frame	CS, LS SN, GA				
Time to load after resuming	CS, LS SN, GA				
Time to load the virtual world	VR				
Time to load the virtual scene	VR				
Time to load augmentation	AR				
Content Stall	CS, LS, SN, VR, GA	Vector of Unsigned Integer	s	Count, Index (1), CDF	
Search Time	CS, LS, SN	Unsigned Integer	s	Average, Deviation, CDF	
{Picture, Video, File} Download Time	CS, SN, HS	Unsigned Integer	s	Average, Deviation, CDF	
{Picture, Video, File} Upload Time	CS, SN, HS	Unsigned Integer	s	Average, Deviation, CDF	
Video Resolution	CS, SN, LS, AR, VR, GA	Vector of Nominal	n/a	Mode, CDF	

Table 25 – Application Network Resources Usage (NWR) Key Performance Indicators

Measurements	**Use Cases**	**Type**	**Unit**	**Summarization**	**KPI**
DL IP data usage	All	Unsigned Integer	byte	Average, Deviation, Skewness, Kurtosis	Total DL IP data usage

UL IP data usage	All	Unsigned Integer	byte		Total UL IP data usage

With:

DL IP data usage: Number of bytes transferred in DL direction.

UL IP data usage: Number of bytes transferred in UL direction.

8.2   Mobile devices test cases

Table 26 – Mobile devices User Experience with reference apps (DRA) KPIs

Measurements	**Use Cases**	**Type**	**Unit**	**Summarization**	**KPI**
Access Time	All	Unsigned Integer	n/a	Average, Deviation, CDF	App Access Time
Accessibility	All	Boolean	n/a	Ratio	App Accessibility
Availability	All	Boolean	n/a	Ratio	App Availability
Cut off	All	Boolean	n/a	Ratio	App Availability
Time to load first media frame	CS, LS SN, GA	Unsigned Integer	s	Average, Deviation, CDF	Content Load Time
Time to load after resuming	CS, LS SN, GA				
Time to load the virtual world	VR				
Time to load the virtual scene	VR				
Time to load augmentation	AR				
Time to load the first game	GA				
Time to load the second game	GA				
Response Time	VR, AR, GA	Unsigned Integer	S	Average, Deviation, CDF	Response Time
Playback	CS, LS, SN	Boolean	n/a	Ratio	Feature Availability
Pause Operation	CS, SN, HS, GA				
Resume Operation	CS, SN, HS, GA				
Stop Operation	CS, LS, SN				
Rewind Operation	CS				
Fast Forward Operation	CS				
Search Operation	CS, LS, SN				
Seek Operation	CS				

Skip Forward Operation	CS				
Skip Backward Operation	CS				
{Picture, Video, Comment, File} Transfer	CS, SN, HS				
Load Augmentation Layer Operation	AR				
Clear Augmentation Layer Operation	AR				
Start Game Operation	GA				
Content Stall	CS, LS, SN, VR, GA	Vector of Unsigned Integer	s	Count, Index (1), CDF	Content Stall
Search Time	CS, LS, SN	Unsigned Integer	s	Average, Deviation, CDF	Content Search Time
{Picture, Video, File} Download Time	CS, SN, HS	Unsigned Integer	s	Average, Deviation, CDF	Content Download Throughput
{Picture, Video, File} Upload Time	CS, SN, HS	Unsigned Integer	s	Average, Deviation, CDF	Content Upload Throughput
Video Resolution	CS, SN, LS, AR, VR, GA	Vector of Nominal	n/a	Mode, CDF	Content Resolution

Table 27 – Mobile Devices Energy consumption (DEC) Key Performance Indicators

Measurements	Use Cases	Type	Unit	Summarization	KPI
Current consumption	All	Unsigned Integer	mA	Average, Deviation, Skewness, Kurtosis	App Power Consumption

Table 28 – Mobile Devices Radio Performance (RFP) Key Performance Indicators

Measurements	Use Cases	Type	Unit	Summarization	KPI
Sensitivity level	HS	Unsigned float	dBm	Average, Deviation, CDF	Sensitivity
AC Selectivity level	HS	Unsigned float	dBm	Average, Deviation, CDF	Adjacent Channel Selectivity

Table 29 – Mobile Devices Data Performance (DDP) Key Performance Indicators

Measurements	Use Cases	Type	Unit	Summarization	KPI

DL IP data usage	All	Unsigned Integer	byte	Average, Deviation, Skewness, Kurtosis	Total DL IP data usage
UL IP data usage	All	Unsigned Integer	byte		Total UL IP data usage

8.3   IoT devices test cases

Table 30 – IoT devices Energy consumption (IEC) Key Performance Indicators

Measurements	Use Cases	Type	Unit	Summarization	KPI
Current consumption	All	Unsigned Integer	mA	Average, Deviation, Skewness, Kurtosis	App Consumption

Table 31 – IoT devices Data Performance (IDP) Key Performance Indicators

Measurements	Use Cases	Type	Unit	Summarization	KPI
DL IP data usage	All	Unsigned Integer	byte	Average, Deviation, Skewness, Kurtosis	Total DL IP data usage
UL IP data usage	All	Unsigned Integer	byte		Total UL IP data usage

Table 32 – IoT devices Reliability (IDR) Key Performance Indicators

Measurements	Use Cases	Type	Unit	Summarization	KPI
Stream Availability	ES	Boolean	n/a	Ratio	Availability
Stream Cutoff	ES	Boolean	n/a	Ratio	
Video Resolution	ES	Vector of Nominal	n/a	Mode, CDF	Content Resolution
Stream Availability after power failure	ES	Boolean	n/a	Ratio	Recovery after fail
Stream Cutoff after power failure	ES	Boolean	n/a	Ratio	
Video Resolution after power failure	ES	Vector of Nominal	n/a	Mode, CDF	
Recovery Time	ES	Unsigned Integer	s	Average, Deviation, CDF	Recovery Time

9   ICS

This section lists the ICS items that have been defined in the TRIANGLE Test Specification.

The meaning of the contents of the status tables is stated in section 9.5.

9.1   Common

This section shows common ICS items that are applicable to all SUT. ICS items shown in this section may be used by all TRIANGLE Test Specifications (defined in D2.2 Appendices).

Table A.1. General Information

Item	Description	Status	Supported values	Support	Mnemonic
1	Type of product	M1	Application, Mobile device, IoT device		ICSG_ProductType
2	Type of IoT device: Grid Powered, Long Lasting battery or Short Lasting battery IoT device)	C01	GP-IoT, LL-IoT, SL-IoT		ICSG_IoTDeviceType e
3	Supported use cases: Virtual Reality, Gaming, Augmented Reality, Content Distribution Streaming Services, Live Streaming Services, Social Networking, High Speed Internet, Patient Monitoring, Emergency Services, Smart Metering, Smart Grids and Connected Vehicles	Mn	VR, GA, AR, CS, LS, SN, HS, PM, ES, SM, SG, CV		ICSG_UseCases

C.01   *IF (A.1/1 = IoT device) THEN Mn ELSE N/A*

Note: This table requires values other than Boolean values.

9.2   Applications

This section shows ICS items that are applicable only to Applications. ICS items shown in this section may be used by all TRIANGLE Test Specifications.

Table A.2. Apps supported features (only applicable if A.1/1 = Application**)**

Item	Description	Status	Support	Mnemonic
1	*Support of Login*	*O*		*ICSA_Login*
2	*Support of logout*	*C.03*		*ICSA_Logout*
3	*Support of open menu*	*O*		*ICSA_OpenMenu*

4	*Support of activate backgroundservice*	*O*		*ICSA_Background*
5	*Support of play content (video/song)*	*C.01*		*ICSA_CSPlay*
6	*Support of re-play content*	*C.01*		*ICSA_CSrReplay*
7	*Support of skip forward content*	*C.02*		*ICSA_CSSkipForward*
8	*Support of fast forward content*	*C.02*		*ICSA_CSFastForward*
9	*Support of skip backward content*	*C.02*		*ICSA_CSSkipBackward*
10	*Support of rewind content*	*C.02*		*ICSA_CSRewind*
11	*Support of pause content (video/song)*	*C.02*		*ICSA_CSPause*
12	*Support of X8 speed fast forward content*	*C.04*		*ICSA_CSFastForwardX8*
13	*Support of X8 speed rewind content*	*C.05*		*ICSA_CSRewindX8*
14	*Support of Download content for offline playing*	*C.02*		*ICSA_CSDownloadMedia*
15	*Support of post text*	*C.06*		*ICSA_SNPostText*
16	*Support of post text and image*	*C.07*		*ICSA_SNPostImage*
17	*Support of post text and video*	*C.07*		*ICSA_SNPostVideo*
18	*Support of post text and location*	*C.07*		*ICSA_SNPostLocation*
19	*Support of post file*	*C.07*		*ICSA_SNPostFile*
20	*Support of get image*	*C.07*		*ICSA_SNGetImage*
21	*Support of get video*	*C.07*		*ICSA_SNGetVideo*
22	*Support of get live video*	*C.07*		*ICSA_SNGetLiveVideo*
23	*Support of get location*	*C.07*		*ICSA_SNGetLocation*
24	*Support of get file*	*C.07*		*ICSA_SNGetFile*
25	*Support of save game session*	*C.09*		*ICSA_GASave*
26	*Support of pause game session*	*C.09*		*ICSA_GAPause*
27	*Support of search and seek*	*C.02*		*ICSA_CSSearchSeek*
28	*Support of play content with screen off*	*C.02*		*ICSA_CSPlayScreenOff*
29	*Support of broadcast live video with screen off*	*C.08*		*ICSA_LSBroadcastScreenOff*

C.01   IF (A.1/3 INCLUDES CS) THEN M ELSE N/A
C.02   IF (A.1/3 INCLUDES CS) THEN O ELSE N/A
C.03   IF (A.2/1) THEN M ELSE N/A
C.04   IF (A.2/8) THEN O ELSE N/A
C.05   IF (A.2/10) THEN O ELSE N/A
C.06   IF (A.1/3 INCLUDES SN) THEN M ELSE N/A
C.07   IF (A.1/3 INCLUDES SN) THEN O ELSE N/A
C.08   IF (A.1/3 INCLUDES LS) THEN O ELSE N/A
C.09   IF (A.1/3 INCLUDES GA) THEN O ELSE N/A

Note: Items in this table only can take Boolean 'Yes' or 'No' values (Support column).

9.3   Mobile devices

Table A3. Mobile devices Features (Only applicable if A.1/1 = Mobile device**)**

Item	Description	Status	Support	Mnemonic
1	Support of Video Playing	M		ICSDM_PlayVideo
2	Support of Video Recording	O		ICSDM_RecordVideo
3	Support of Virtual Reality	O		ICSDM_VirtualReality
4	Support of Augmented Reality	O		ICSDM_AugmentedReality

Note: Items in this table only can take Boolean 'Yes' or 'No' values (Support column).

9.4   IoT devices

Table A4. IoT devices Features (Only applicable if A.1/1 = IoT device**)**

Item	Description	Status	Support	Mnemonic
1	Support of Playing received video	O		ICSDI_ReceiveVideo
2	Support of Video transmission	O		ICSDI_TransmitVideo
3	Support of Playing Received audio	O		ICSDI_ReceiveAudio
4	Support of Audio transmission	O		ICSDI_TransmitAudio
5	Support of Idle mode	O		ICSDI_IdleMode
6	Support of Audio transmission without Video	C.01		ICSDI_TransmitAudioWithoutVideo

7	Support of Playing received Audio without Video	C.02		ICSDI_ReceiveAudioWithoutVideo
8	Device is connected to a Battery	O		ICSDI_Battery

C.01   *IF A.4/4 THEN O ELSE N/A*
C.02   *IF A.4/3 THEN O ELSE N/A*

Note: Items in this table only can take Boolean 'Yes' or 'No' values (Support column).

9.5   ICS template

This section indicates the ICS proformas to be used by the ICS tables.

The supplier of the device or application implementation shall complete the ICS proformas by filling the 'Support' column.

Two ICS proforma templates are defined depending of the supported values of the 'Support' column.

9.5.1   Support column with Boolean values

ICS tables with items that can only take a Boolean value in the 'Support' column will use the following template.

Table 33 –ICS template for Support column with Boolean values

Item	Description	Status	Support	Mnemonic
1				
2				
3				
....				

List of conditional expressions

9.5.2   Support column with multiple values

ICS tables with items that can take multiple values in the 'Support' column will use the following template.

Table 34 – ICS template for Support column with multiple values

Item	Description	Status	Supported values	Support	Mnemonic
1					
2					

3					
....					

List of conditional expressions

The description of the columns contents for both templates is detailed in the table below.

Table 35 – ICS Proforma columns

Column	Description
Item	The item column contains a number which identifies the item in the table.
Description	The item column contains the ICS name
Status	The following notations are used for the status column: M　　mandatory – the capability is required to be supported. M1　　mandatory, only 1 option may be supported Mn　　mandatory, at least one option is supported; many options may be supported. O　　optional – the capability may be supported or not. N/A　　not applicable – in the given context, it is impossible to use the capability. C.i　　conditional – the requirement on the capability ("M", "O" or "N/A") depends on the support of other optional or conditional items. "i" is an integer identifying an unique conditional status expression which is defined immediately following the table. For nested conditional expressions, the syntax "IF ... THEN (IF ... THEN ... ELSE...) ELSE ..." shall be used to avoid ambiguities.
Support	The support column shall be filled in by the supplier of the implementation. The following common notations are used for the support column: Y or y　　supported by the implementation N or n　　not supported by the implementation N/A, n/a or -　no answer required (allowed only if the status is N/A, directly or after evaluation of a conditional status)
Mnemonic	The Mnemonic column contains mnemonic identifiers for each item.
Supported values	List of supported vales

10 IXIT

10.1 Applications

This section shows IXIT items that are applicable only to applications

Table B1. Applications IXIT (Only applicable if A.1/1 = Application)

Item	Name	Supported values	Mnemonic	Value
1	Operating System	Android, iOS	IXITD_OperatingSystem	

10.2 Devices

This section shows IXIT items that are applicable only to devices (mobile devices and IoT devices).

Table B2. Devices IXIT (Only applicable if A.1/1 = Mobile device OR A.1/1 = IoT device)

Item	Name	Supported values	Mnemonic	Value
1	Supported cellular technologies	GSM, UMTS, LTE, 5G	IXITD_CellularTechnology	
2	Supported frequency bands	As per TS 36.521-2 Table A.4.3-3	IXITD_Bands	
3	UE Power Class	As per TS 36.521-2 Table A.4.3-3b	IXITD_UEPowerClass	
4	Supported channel bandwidths	As per TS 36.521-2 Table A.4.3-3a	IXITD_Bandwidths	
5	UE Category	As per TS 36.521-2 Table A.4.3-4 and Table A.4.3-4a0	IXITD_UECategory	
6	UE Downlink Category	As per TS 36.521-2 Table A.4.3-4a and Table A.4.3-4aa	IXITD_DLCategory	
7	UE Uplink Category	As per TS 36.521-2 Table A.4.3-4b and Table A.4.3-4ba	IXITD_ULCategory	
8	Nominal working voltage		IXITD_NormalVoltage	

10.3 IXIT template

This section indicates the IXIT proforma to be used for the definition of IXIT items..

The table below will be used as IXIT template for the required IXIT tables

Table 36 –IXIT template

Item	Description	Supported values	Mnemonic	Value
1				
2				
3				
......				

11 Annex A. Test Specification General Concepts

In order to complete TRIANGLE certification, a device or application implementation needs to be evaluated under a set of certification requirements.

The different certification requirements are verified by the execution of individual test cases. The complete description of the test cases is defined in a set of Test Specifications.

A different Test Specification will be created for all the domains identified in TRIANGLE project to include all the test cases required to evaluate a specific domain. Table 37 lists the domains identified for TRIANGLE certification and the domains applicable for the defined SUTs.

Table 37 – TRIANGLE domains

Domain	Application	Mobile device	IoT device
Reliability	Yes		Yes
Network Resources usage	Yes		
User Experience	Yes		
Device Resources usage	Yes		
Energy Consumption	Yes	Yes	Yes
Data Performance		Yes	Yes
Radio Performance		Yes	
User Experience with Reference Apps		Yes	

TRIANGLE mark covers different Systems Under Test (SUT): Applications and Devices. Devices can be also subcategorized into mobile devices and IoT devices. Test Specifications are separated according to the different SUTs. Accordingly, the Test Specification is divided in the following groups of test cases listed in Table 38.

Table 38 – TRIANGLE Test Specifications

System under Test	Domain	Identifier	Test Specification
Application	Reliability	REL	Applications Reliability Test Specifications
Application	Network Resources usage	NWR	Applications Network Resources usage
Application	User Experience	AUE	Applications User Experience
Application	Device Resources usage	RES	Applications Device Resources usage
Application	Network Adaptation	NWA	Applications Network Adaptation
Application	Energy Consumption	AEC	Applications Energy Consumption
Mobile device	Data Performance	QOS	Mobile devices Data Performance
Mobile device	Radio Performance	RFP	Mobile devices Radio Performance
Mobile device	Energy Consumption	DEC	Mobile devices Energy Consumption

Mobile device	User Experience with reference apps	DRA	Mobile devices User Experience with reference apps
IoT device	Reliability	IDR	IoT Devices Reliability
IoT device	Network Adaptation	INA	IoT Devices Network Adaptation
IoT device	Radio Performance	IRP	IoT Devices Radio Performance
IoT device	Data Performance	IDP	IoT Devices Data Performance
IoT device	Energy Consumption	IEC	IoT Devices Energy Consumption

Test Specification test cases are organized by use cases (as shown inTable 40).

Table 39 shows the use cases that have been defined for TRIANGLE Certification and the contents of testing that are applicable to the use cases:

Table 39 – TRIANGLE Use cases

Identifier	Use Case	Application	Mobile device	IoT Device
VR	Virtual Reality	Yes	Yes	
GA	Gaming	Yes	Yes	
AR	Augmented Reality	Yes	Yes	
CS	Content Distribution Streaming Services	Yes	Yes	
LS	Live Streaming Services	Yes	Yes	
SN	Social Networking	Yes	Yes	
HS	High Speed Internet	Yes	Yes	
PM	Patient Monitoring		Yes	Yes
ES	Emergency Services		Yes	Yes
SM	Smart Metering		Yes	Yes
SG	Smart Grids		Yes	Yes
CV	Connected Vehicles		Yes	Yes

Table 40 shows the use cases applicable to the defined test specifications.

Table 40 – TRIANGLE Use cases applicability per Test Specification

TS ID	VR	GA	AR	CS	LS	SN	HS	PM	ES	SM	SG	CV
	Virtual Reality	Gaming	Augmented Reality	Content Distribution Streaming Services	Live Streaming Services	Social Networking	High Speed Internet	Patient Monitoring	Emergency Services	Smart Metering	Smart Grids	Connected Vehicles
REL	■	■	■	■	■	■	■	■	■			
NWR	■	■	■	■	■	■	■	■	■			
AUE	■	■	■	■	■	■	■	■	■			
RES	■	■	■	■	■	■	■	■	■			
NWA	■	■	■	■	■	■	■	■	■			
AEC	■	■	■	■	■	■	■	■	■			
DEC	■	■	■	■	■	■	■	■	■	■	■	■
QOS	■	■	■	■	■	■	■	■	■	■	■	■
RFP	■	■	■	■	■	■	■	■	■	■	■	■
DRA	■	■	■	■	■	■	■	■	■	■	■	■
IDR								■	■	■	■	■
INA								■	■	■	■	■
IRP								■	■	■	■	■
IDP								■	■	■	■	■
LDP								■	■	■	■	■
LEC								■	■	■	■	■
GEC								■	■	■	■	■
SEC								■	■	■	■	■

11.1 5G Network Scenarios: General Overview

In this section, some of the widely-discussed scenarios for 5G are presented. In contrast to what is available in the literature (see (5GPPP, 2016) and references within), the TRIANGLE project aims at the perspective of the end user, rather than an aggregated network-wise vision. Additional specific use cases of interest for App developers and IoT device manufacturers have been then derived.

The 5G usage scenarios have been divided into macro categories per their commonalities in the network deployment and channel conditions. Each usage scenario is then sub-divided into user and traffic present in the surroundings.

11.1.1 Urban

The urban scenarios are generally characterized by dense urban network deployments. One can think about locations like the London City center, or Manhattan, or Tokyo. Network deployments in urban scenarios are usually characterized by the presence of Macro sites with a reduced or highly reduced inter-site distance, together with the presence of Small Cells as well. Given the need of carrying high amount of traffic, a dense HetNet is required, giving the possibility to the terminal to be connected to Small Cells as Primary Cell as well.

Under this umbrella several 5G usage scenarios characterized by the location and mobility of the users have been identified.

11.1.1.1 Office

This is the typical indoor office environment where users are static. It is characterized by the presence of indoor wireless network access points (both Wi-Fi and Small Cells). The channel and interference conditions are also dictated by the penetration of signals coming from the outdoor cells, mostly macro sites. The expected traffic scenario is related to typical broadband access with a mixture of applications.

11.1.1.2 Pedestrian

This is the usual scenario of a user walking down an urban street at 1 to 3 km/h. It is expected that the channel conditions can change due to the presence of moving obstacles e.g. trucks and buses. Even in this case a typical broadband access is the baseline for the traffic-generating applications.

11.1.1.3 Driving

It is becoming more and more common to have wireless modems inside the car that allow direct connectivity to the onboard computer and entertainment system. Given the urban environment, the expected speed of the vehicle is up to 60 km/h. The traffic conditions are here very dependent on the application, since V2I traffic for vehicular control could also be foreseen.

11.1.1.3.1 Normal

In normal vehicular traffic conditions, the speed is expected to be on the high end of the urban limits, possibly 40 to 60 km/h. The density of the users on the road is here reasonably low, given the regulatory distance between vehicles.

11.1.1.3.2 Traffic jam

In a traffic jam it is expected that the vehicles will be more packed, resulting in a higher density, while the speed tends to be from very low to almost static. The users are then expected to do a heavier use of, for example, their own entertainment system creating a heavier load on the network.

11.1.1.3.3 Emergency Driving

An interesting case for e-health is the path that an ambulance is following when called for an emergency. Despite of the urban settings, the ambulance can drive faster than the limits (60 to 120 km/h). While the ambulance is the most important civilian case, the same type of scenario could be applied to public forces acting on emergency calls for safety and security, from fire fighters to police.

11.1.1.4 Internet Cafè

While this scenario can be substantially derived from both the office and pedestrian one, we believe it has a value for the App developers, and it is easy to understand for non-experts. The scenario is a typical multi-RAT scenario with users mostly static, with some channel variations due to the street-level nature of the location (moving objects on the street, some indoor penetration).

11.1.1.4.1 Busy Hours

During for example lunch hours on a weekday the cafè is expected to be full of customer who are trying to access the network for consuming services. This affects the network load and the amount of resources that each customer can get from the network.

11.1.1.4.2 Off-Peak

During for example a mid-afternoon the number of customers in the cafè decreases, creating easier conditions for network access. At the same time the type of imperfections that affect the channel (interference from other customers, amount of moving shielding objects) is also reduced.

11.1.2 Sub-Urban

The sub-urban umbrella contains all those scenarios which are generally located outside the city centre, in less densely populated areas. For this reason, most of the access site to the network is macro only, mounted on higher rise towers for coverage, with a larger inter-site distance.

Few sporadic Small Cell hotspots are eventually encountered within the coverage area of the macros, either for localized capacity boosting or for reinforcing the coverage. All the sub-cases of interest in these network and propagation conditions are related to the concentrated and massive presence of users.

11.1.2.1 Festival

This usage scenario is typically outdoor, with additions of few localized macro sites and Small Cells for increased capacity. The type of expected traffic is mostly consistent with a very dense broadband access, with eventual broadcasting of the concerts in the festival area.

11.1.2.2 Stadium

This is the scenario with the highest density of users. Hotspots cover the stadium area, but its main characteristic is the balancing between the amount of access points and the interference generated.

11.1.2.3 Shopping Mall

The physical environment is characterized by indoor large spaces, with a certain amount of electromagnetic reflecting materials. Mixed applications are expected to run in the network, for both business internal and external customers' purposes.

11.1.2.3.1 Busy hours

Considering e.g. a Saturday noon, the Shopping Mall is expected to be flooded with customers, and both the business internal and customers' traffic is expected to overload the network.

11.1.2.3.2 Off-Peak

Fewer customers present in the premises, partly changing not only the traffic but also the propagation conditions as well.

11.1.3 High speed train

High speed collective transport, similarly to current scenarios present in Japan, is considered a valuable scenario for 5G where both commercial traffic and critical vehicular control should coexist in the same radio access. The propagation condition is a rural one, with relatively sparse macro sites densified for the railroad coverage purpose. The speed of the train is very high, up to 350 km/h. Two different ways of dealing with the users' affiliation represent the main technical challenges for 5G and how the system should behave.

11.1.3.1 Relay

One way of dealing with the users' affiliation to the network is by installing a relay (or self-backhauled as sometimes referred to in 5G literature) or an access gateway for Wi-Fi on the train. Since there is only one device affiliated to the fixed wireless network, the C-plane is not the bottleneck, but the aggregated traffic of all the users creates a massive "super-user" which requires great amount of the U-plane resources.

11.1.3.2 Direct passenger connections

In contrast to the previous scenario, each user is dealt individually by the fixed network. While each user has a limited amount of U-plane resources to be scheduled, the C-plane and the so-called "massive handover" can create difficulties to the networks and impairments to the data flow for the users, impacting their QoE.

11.1.4 Internet of Things

Given the radically different nature of the devices and the traffic, IoT requires a category on its own. The devices are usually low-power, low performance. The traffic is heavily sporadic and consists of very small packets, roughly around 160 bytes.

11.1.4.1 Warehouse

This scenario represents IoT devices which are located in typical industrial setting, i.e., a warehouse, where multiple metallic structures often block the signal and introduce harsh environment to the RF signal.

11.1.4.2 Outdoor sensors

This scenario represents the situation where outdoor sensors are massively deployed in an urban setting.The major issue of this scenario is the amount of interference generated by the other devices trying to access the network.

11.1.4.3 Home sensors (basement)

Another scenario of interest is the deployment of home sensors for, e.g., electricity measurement. While power consumption is not a major issue for such devices since they are connected to the power grid, the coverage conditions can be poor, due to the nature of the installation, possibly in a basement with thick walls, where absorbing and reflecting materials heavily shadow the device.

11.2 Scenarios and use cases

Table 41 lists the scenarios and sub-scenarios identified for TRIANGLE certification as defined in previous chapter.

Table 41 – TRIANGLE Scenarios

Scenario	Scenario Description	Sub-Scenario	Sub-scenario Description
UR	Urban	OF	Office
		PE	Pedestrian
		DN	Driving, Normal
		DT	Driving, Traffic jam
		DE	Driving, Emergency driving
		IB	Internet Cafe, Busy hours
		IO	Internet Cafe, Off-Peak
SU	Sub-Urban	FE	Festival
		ST	Stadium
		SB	Shopping Mall, Busy hours
		SO	Shopping Mall, Off-Peak
HS	High Speed Train	RE	Relay
		DP	Direct Passenger connections
IT	Internet of Things	WA	Warehouse
		OS	Outdoor sensors
		HS	Home sensors

Each test case will be executed for all the scenarios that are relevant to the SUT and to that specific test case. Table 43 Table 43 - Parameter set for an LTE-based network scenarioindicates the scenarios to be tested according to the use cases supported by the SUT.

Table 42 –Scenarios by use case

| Network Scenarios | | Use cases | | | | | | | | | | |
SC	Scenario	CS	LS	SN	HS	VR	AR	GA	PM	ES	SM	SG	CV
UR-OF	Urban-Office	Y		Y	Y	Y	Y	Y		Y	Y		
UR-PE	Urban-Pedestrian	Y	Y	Y	Y		Y	Y					
UR-DN	Urban-Driving-Normal	Y	Y	Y	Y		Y	Y	Y				Y
UR-DT	Urban-Driving-Traffic jam	Y		Y	Y		Y	Y	Y				Y
UR-DE	Urban-Driving-Emergency driving		Y	Y	Y		Y		Y	Y			Y
UR-IB	Urban-Internet Café, Busy Hours	Y		Y	Y	Y	Y	Y					
UR-IO	Urban-Internet Cafe, Off-Peak	Y		Y	Y	Y	Y	Y					
SU-FE	Suburban-Festival	Y	Y	Y	Y		Y	Y		Y			
SU-ST	Suburban-Stadium	Y	Y	Y	Y		Y	Y		Y			
SU-SB	Suburban-Shopping Mall, Busy Hours	Y		Y	Y		Y	Y		Y			
SU-SO	Suburban-Shopping Mall, Off-Peak	Y		Y	Y		Y	Y		Y			
HS-RE	High Speed-Relay	Y		Y	Y			Y					Y
HS-DP	High Speed-Direct Passenger Connection	Y		Y	Y			Y					Y
IT-WA	Internet of Things-Warehouse										Y		
IT-OS	Internet of Things-Outdoor Sensors										Y	Y	
IT-HS	Internet of Things-Home Sensors								Y		Y	Y	

11.3   Test cases naming convention

This section defines the naming convention to create the reference associated to each test case.

The proposal to name test cases references is the following one:

Generic Test case name: ***TSI/UC//XXX***

Test case name with specific scenario: ***TSI/UC/XXX[SC/SS]***

Where:

TSI: Test Specification Identifier, as defined in Table 38.

UC: TRIANGLE 5G Use case as defined in Table 39.

SC: TRIANGLE Scenario as defined in Table 41.

SS: Sub-Scenario belonging to the SC scenario as defined inTable 41.

XXX: Test case number

11.4   Test case description

This section describes the required contents to define a test case to be included in section of this Test Specification (as defined in Table 18).

The definition of a test case will include the following fields:

Test case Identifier:	According to Test Naming convention
Test case Title:	Name of the test case
Test case objective:	Describe the test case and its objective
Test case applicability:	Define devices / application that have to execute the test case according to the ICS values.
Test case Initial Conditions:	Initial configuration and state of the entities taking part in the test case
Test case Steps:	Steps to perform the test case
Measurements:	Measurements that are performed in the test case execution

12 Annex B. Network Scenarios Parameterisation.

12.1 Definition of Scenario Parameters

The wireless cellular networks have a vast number of parameters to be set to ensure a correct functioning of the system. Besides to the parameters of the technology itself, while defining the scenarios, more fine grained details about the environment conditions need to be set in the testbed.

Part of the parameters to be set are dependent on the Device Under Test (DUT) or which reference device is in use. As a matter of fact, different User Equipment (UEs) support different feature from different technology Releases. This factor partially limits the number of common parameters to be set in the scenario description for the testing purposes.

The following table has been selected as containing all the major, relevant parameters for the description of each scenario:

Table 43 - Parameter set for an LTE-based network scenario

Serving cell	RSRP
	Noise/Interference
	Channel model
	Channel model Doppler
	Channel model correlation
LTE scheduling	Frequency domain (DL)
	Time domain (DL)
	Frequency domain (UL)
	Time domain (UL)
Network	Additional each way latency

LTE scheduling parameters must be considered average values that can follow certain time dynamics.

Network latency is also reported as average value follow a certain distribution.

Parameters such as antenna configuration, transmission mode, maximum achievable MCS should be considered device dependent, and they should be set as per achieving maximum performance for the DUT/reference device.

Other parameters that are purely network configurations are normally set as most commonly used, de-facto default values. Example of such parameters can be:

- cyclic prefix length: short

- Max number of HARQ re-transmissions: 4

- BLER Target for first transmission: 30%

- Standard bearer QoS: default bearer

To guarantee the most realistic conditions in each of the scenarios, several sub-scenarios have been defined. Each of the sub-scenarios depict e.g. a different time of the day where different number of users are present in the network, or the environment can suffer from more radical changes.

12.2 Scenario Parameters Setting

Table 44 - Urban-Office Scenario Parameters

		Urban-Office				
		UR-OF				
High level scenario description		Business building area - stationary user, good coverage, high number of users				
Sub-scenario description		**Default working conditions** (average NW & cell load)	**Daily servers back-up/git clone/OS updates deployment** (high NW latency due to multiple small packets)	**After lunch break** (many users light browsing, spurious traffic)	**Videoconference calls over 5G** (Many users, heavy combined load, scattered free bandwidth)	**Late night/weekend crunch** (light NW & cell load)
Serving cell	RSRP	fixed at -90dBm	fixed at -90dBm	fixed at -90dBm	fixed at -90dBm	fixed at -90dBm
	AWGN	Constant AWGN level for average SNR = 25dB	Constant AWGN level for average SNR = 25dB	Constant AWGN level for average SNR = 25dB	Constant AWGN level for average SNR = 25dB	Constant AWGN level for average SNR = 25dB
	Channel model	EPA	EPA	EPA	EPA	EPA
	Channel model Doppler	5 Hz	5 Hz	5 Hz	5 Hz	5 Hz
	Channel model correlation	Medium	Medium	Medium	Medium	Medium
LTE scheduling	Frequency domain (DL)	50% of PRBs	30% of PRBs	40% of PRBs	20%	50%
	Time domain (DL)	30% of subframes	30% of subframes	30% of subframes	20%	100%
	Frequency domain (UL)	50% of PRBs	30% of PRBs	40% of PRBs	20%	50%
	Time domain (UL)	30% of subframes	30% of subframes	30% of subframes	20%	100%
Network	Additional each way latency	0ms	150ms	0ms to 50ms	100ms	0ms
Comments		Medium correlation due to offices being in skyscrapers/tall buildings				Cell shared between at max 2 users
	Modules	**A**	**B**	**C**	**D**	**E**
	Typical flow:	8am-9am, 10am-12pm, 4pm-5pm	9am-10am	1pm-2pm	2pm-4pm	5pm-6pm
	Full scenario flow:	A, B, A, A, C, D, D, A, E, E 30 seconds each, 5 minutes total				

Table 45 - Urban-Pedestrian Scenario Parameters

		Urban-Pedestrian			
		UR-PE			
High level scenario description		Slowly moving user, good to average coverage, occasional high number of users, no handovers			
Sub-scenario description		**Center to park walk** Walking from near cell to mid cell coverage	**Busy green area - park** Walking around in mid cell, high number of users	**Park to center walk** Return to near cell conditions	**City main square** (good conditions, many users)
Serving cell	RSRP	from -90dBm down to -105dBm, linear decrease with 4 seconds per 1dB step, total scenario length of 64 seconds	-105dBm	from -105 back to -90dBm 4 seconds per 1 dB step	-90dBm
	AWGN	AWGN injected to drop from 25dB to 10dB, fixed compared to RSRP, identically 1dB drop every 4 seconds	10dB	from 10dB to 25dB 4 seconds per 1 dB step	25dB
	Channel model	EPA	EPA	EPA	EPA
	Channel model Doppler	5 Hz	5 Hz	5 Hz	5 Hz
	Channel model correlation	Low (at RSRP > -98dBm) Medium (at RSRP < -98dBm)	Medium	Low (at RSRP > -98dBm) Medium (at RSRP < -98dBm)	Low
LTE scheduling	Frequency domain (DL)	50% of PRBs	40% of PRBs	50% of PRBs	30% of PRBs
	Time domain (DL)	30% of subframes	30% of subframes	30% of subframes	30% of subframes
	Frequency domain (UL)	50% of PRBs	40% of PRBs	50% of PRBs	30% of PRBs
	Time domain (UL)	30% of subframes	30% of subframes	30% of subframes	30% of subframes
Network	Additional each way latency	0 to 50 ms (at each RSRP step, increase by 3ms)	50 ms	50 to 0 ms (at each RSRP step, decrease by 3ms)	0ms
Comments		potentially add handovers here		and here	
	Modules	A	B	C	D
	Typical flow:				
	Full scenario flow:	A, B, C, D			

Table 46 - Urban Driving Scenarios Parameters (Normal, Traffic Jam, Emergency)

		Urban-Driving-Normal		Urban-Driving-Traffic jam		Urban-Driving-Emergency driving	
		UR-DN		UR-DT		UR-DE	
High level scenario description		driving user, average coverage, low number of users		slowly moving user, high number of users,		high speed driving, identical coverage as	
Sub-scenario description		**Light traffic** (faster driving, fewer users)	**Heavy traffic** (slower driving, more users)	**Ordinary traffic jam conditions**	**Multiple emergency response vehicles drive fast in next lane**	**Default emergency driving** (in light traffic)	**Default emergency driving** (in heavy traffic)
Serving cell	RSRP	from -90dBm to -119dBm, 1.5dB drop per second, resulting in mean time between handovers of 20 seconds	from -90dBm to -119dBm, 1dB drop per second, 30 seconds in average between handovers	around -100dBm, fixed	around -100dBm, fixed	from -90dBm to -119dBm, with 3dB drop per second, with average time of 10s between handovers	from -90dBm to -119dBm, with 3dB drop per second, with average time of 10s between handovers
	AWGN	between 25dB to 10dB , 1.5dB drop/increase per second	between 25dB to 10dB, 1dB drop/increase per second	around 10dB	around 10dB	between 25dB to 10dB 3dB drop/increase per second	between 25dB to 10dB 3dB drop/increase per second
	Channel model	EVA	EVA	EVA	EVA	EVA	EVA
	Channel model Doppler	75Hz	50Hz	25Hz	150 Hz	150Hz	150Hz
	Channel model correlation	Medium	Medium	Medium	Medium	Medium	Medium
LTE scheduling	Frequency domain (DL)	100% of PRBs	50% of PRBs	20% of PRBs	20% of PRBs	100% of PRBs	50% of PRBs
	Time domain (DL)	50% of subframes	30% of subframes	20% of subframes	20% of subframes	50% of subframes	30% of subframes
	Frequency domain (UL)	100% of PRBs	50% of PRBs	20% of PRBs	20% of PRBs	100% of PRBs	50% of PRBs
	Time domain (UL)	50% of subframes	30% of subframes	20% of subframes	20% of subframes	50% of subframes	30% of subframes
Network	Additional each way latency	0 to 50 ms (at each RSRP step, increase by 3ms)	50ms to 100ms (at each RSRP step, increase by 3ms)	75ms	75ms	0ms to 50ms (at each RSRP step, increase by 5ms)	50ms to 100ms (at each RSRP step, increase by 5ms)
Comments							
	Modules	A	B	A	B	A	B
	Typical flow:						
	Full scenario flow:	A, B		A, A, A, B, A, A, A			

Table 47 - Urban Internet Café Scenarios Parameters (Busy Hours, Off-Peak)

		Urban-Internet Cafè, Busy Hours			Urban-Internet Cafè, Off-Peak		
		UR-IB			UR-IO		
High level scenario description		good coverage, but many users instagramming their coffee mugs			good coverage, same number of users as pedestrian, stationary		
Sub-scenario description		**Average coffee shop**	**Heavy car traffic in front** (worse radio channel - higher AWGN, lower power)	**User spills coffee on device** (user rubbing phone on clothes - changing correlation)	**Average coffee shop**	Heavy car traffic in front (worse radio channel - higher AWGN, lower power)	User spills coffee on device (user rubbing phone on clothes - changing correlation)
Serving cell	RSRP	fixed at -95dBm (worse than business area)	drops to -105dBm	fixed at -95dBm (worse than business area)	fixed at -95dBm (worse than business area)	drops to -105dBm	fixed at -95dBm (worse than business area)
	AWGN	fixed at 20dB	drops to 10dB	fixed at 20dB	fixed at 20dB	drops to 10dB	fixed at 20dB
	Channel model	EPA	EPA	EPA	EPA	EPA	EPA
	Channel model Doppler	5 Hz	20 Hz	5 Hz	5 Hz	20 Hz	5 Hz
	Channel model correlation	Low	Low	Medium	Low	Low	Medium
LTE scheduling	Frequency domain (DL)	20 % of PRBs	20 % of PRBs	20 % of PRBs	100% of PRBs	100% of PRBs	100% of PRBs
	Time domain (DL)	20% of subframes	20% of subframes	20% of subframes	20% of subframes	20% of subframes	20% of subframes
	Frequency domain (UL)	20 % of PRBs	20 % of PRBs	20 % of PRBs	100% of PRBs	100% of PRBs	100% of PRBs
	Time domain (UL)	20% of subframes	20% of subframes	20% of subframes	20% of subframes	20% of subframes	20% of subframes
Network	Additional each way latency	0ms to 50ms	0ms to 50ms	0ms to 50ms	0ms	0ms to 50ms	0ms to 50ms
Comments							
	Modules	**A**	**B**	**C**	**A**	**B**	**C**
	Typical flow:	50%	40%	10%	50%	40%	10%
	Full scenario flow:	A, A, B, A, B, A, A, B, C, B 30 seconds each, 5 minutes total			A, A, B, A, B, A, A, B, C, B 30 seconds each, 5 minutes total		

Table 48 - Suburban Scenarios Parameters (Festival, Stadium)

		Suburban-Festival		Suburban-Stadium	
		SU-FE		SU-ST	
High level scenario description		good coverage (outdoor festival) - away from		average coverage (inside a metal building),	
Sub-scenario description		**Entrance tickets check** (attendees downloading e-tickets - DL starved)	**Popular band playing** (heavy live streaming - UL starved)	**Entrance tickets check** (attendees downloading e-tickets - DL starved)	**Sports game ongoing**
Serving cell	RSRP	fixed at -80dBm	fixed at -80dBm	fixed at -95dBm	fixed at -95dBm
	AWGN	fixed at 30dB	fixed at 30dB	fixed at 15dB	fixed at 15dB
	Channel model	ETU	ETU	ETU	ETU
	Channel model Doppler	5 Hz	5 Hz	5 Hz	5 Hz
	Channel model correlation	Medium	Medium	Medium	Medium
LTE scheduling	Frequency domain (DL)	10 % of PRBs	20 % of PRBs	10 % of PRBs	30% of PRBs
	Time domain (DL)	10% of subframes	20% of subframes	10% of subframes	30% of subframes
	Frequency domain (UL)	20% of PRBs	10 % of PRBs	20 % of PRBs	30% of PRBs
	Time domain (UL)	20% of subframes	10% of subframes	20% of subframes	30% of subframes
Network	Additional each way latency	150ms	150ms	100ms	0ms
Comments					same as city good conditions - many users but not much traffic

Table 49 - Suburban Shopping Mall Scenarios Parameters (Busy Hours, Off-Peak)

		Suburban-Shopping Mall, Busy Hours		Suburban-Shopping Mall, Off-Peak	
		SU-SB		SU-SO	
High level scenario description		poor coverage (multi-stories mall)		poor coverage (multi-stories mall)	
Sub-scenario description		**Ordinary busy mall**	**Online wallet payment** (users pay with apps on phone, no cards/cash)	**Ordinary empty mall**	**Multiple delivering trucs around the mall**
Serving cell	RSRP	fixed at -100dBm	fixed at -100dBm	fixed at -100dBm	fixed at -100dBm
	AWGN	fixed at 5dB	fixed at 5dB	fixed at 5dB	fixed at 5dB
	Channel model	ETU	ETU	ETU	ETU
	Channel model Doppler	5 Hz	5 Hz	5 Hz	70 Hz
	Channel model correlation	High	High	High	High
LTE scheduling	Frequency domain (DL)	20 % of PRBs	10 % of PRBs	100% of PRBs	50% of PRBs
	Time domain (DL)	20% of subframes	10% of subframes	20% of subframes	20% of subframes
	Frequency domain (UL)	20 % of PRBs	10 % of PRBs	100% of PRBs	50% of PRBs
	Time domain (UL)	20% of subframes	10% of subframes	20% of subframes	20% of subframes
Network	Additional each way latency	100ms	100ms	0ms	0ms
Comments		same allocation as busy internet café, but different channel	heavily both DL and UL starved	same allocation as empty internet café, but different channel	higher doppler, smaller allocation

Table 50 - High Speed Train Scenarios Parameters (Direct Connection)

| | | High Speed-Direct Passenger Connection | | High Speed-Relay | |
		HS-DP		HS-RE	
High level scenario description		Each passenger is directly connected to the fixed		All passengers are connected to a mobile "hotspot" (relay)	
Sub-scenario description		**High speed train in suburban area**	**Max speed train in empty fields**	**High speed train in suburban area**	**Max speed train in empty fields**
Serving cell	RSRP	from -90dBm to -119dBm, with 3dB drop per second, with average time of 10s between handovers	from -90dBm to -119dBm, with 5dB drop per second, with average time of 6s between handovers	fixed at -90dBm	fixed at -90dBm
	AWGN	between 25dB to 10dB 3dB drop/increase per second	between 25dB to 10dB, 5dB drop/increase per second	Constant AWGN level for average SNR = 25dB	Constant AWGN level for average SNR = 25dB
	Channel model	HST	HST	Static	Static
	Channel model Doppler	150 Hz	250 Hz	n/a	n/a
	Channel model correlation	n/a	n/a	n/a	n/a
LTE scheduling	Frequency domain (DL)	20 % of PRBs	20 % of PRBs	20 % of PRBs	20 % of PRBs
	Time domain (DL)	20% of subframes	20% of subframes	20% of subframes	20% of subframes
	Frequency domain (UL)	20 % of PRBs	20 % of PRBs	20 % of PRBs	20 % of PRBs
	Time domain (UL)	20% of subframes	20% of subframes	20% of subframes	20% of subframes
Network	Additional each way latency	Latency average: 50ms	Latency average: 75ms	Latency average: 100ms Latency random variation: ± 50ms Packet loss: 1%	Latency average: 150ms Latency random variation: ± 50ms Packet loss: 3%
Comments		Poor channel conditions, very fast handovers, Doppler going back and forth, many simultaneous users. Cells should be configured with a lower max number of retransmissions (maxHARQ-Tx = 2 rather than 4)		Here the channel conditions are great, as they represent the channel between the relay (on top of the train) to the users. The real poor reception will be represented by brutal network settings (latency, jitter, packet loss).	

Table 51 - Internet of Things Scenarios Parameters (Warehouse, Outdoor Sensors, Home Sensors)

		Internet of Things-Warehouse IT-WA		Internet of Things-Outdoor Sensors IT-OS		Internet of Things-Home Sensors IT-HS	
High level scenario description		Very densely sensored area (factory, amazon		Average sparsely sensored area		Very sparsely sensored area	
Sub-scenario description		**Factory scenario** (a lot of moving parts)	**Warehouse scenario** (stationary conditions)	**Daytime** (busy with car traffic, data traffic)	**Nighttime** (no car traffic, little data traffic)	**Sensor in the habitable area**	**Sensor in the basement**
Serving cell	RSRP	-100dBm	-100dBm	-90dBm	-90dBm	-95dBm	-110dBm
	AWGN	10dB	10dB	10dB	10dB	5dB	-5dB
	Channel model	ETU	ETU	ETU	ETU	EPA	EPA
	Channel model Doppler	50 Hz	5 Hz	70 Hz	5 Hz	5Hz	5Hz
	Channel model correlation	Medium	Medium	Medium	Medium	Medium	High
LTE scheduling	Frequency domain (DL)	100% of PRBs	100% of PRBs	20 % of PRBs	100% of PRBs	100% of PRBs	100% of PRBs
	Time domain (DL)	20% of subframes	20% of subframes	20% of subframes	20% of subframes	20% of subframes	20% of subframes
	Frequency domain (UL)	100% of PRBs	100% of PRBs	20 % of PRBs	100% of PRBs	100% of PRBs	100% of PRBs
	Time domain (UL)	20% of subframes	20% of subframes	20% of subframes	20% of subframes	20% of subframes	20% of subframes
Network	Additional each way latency	0ms	0ms	100ms	0ms	0ms	0ms
Comments		control of robots	thermostat, package tracker		lamppost, floor sensor, wind detector	thermostat, electric plug meter	bad coverage scenario (basement, electric closet, bathroom cabinet)

Table 52 – Radio Performance Scenarios Parameters

		Very low coverage	Adjacent interferer
		VLC	AI
High level scenario description		scenario to test UE sentitivity (very low power signal)	adjacent channel with high power
Sub-scenario description		-	-
Serving cell	RSRP	fixed at -95dBm	fixed at -85dBm
	AWGN	Disabled	Disabled
	Channel model	SMIMo	SMIMo
	Channel model Doppler	0 Hz	0 Hz
	Channel model correlation	Low	Low
LTE scheduling	Frequency domain (DL)	100,00%	100,00%
	Time domain (DL)	90,00%	90,00%
	Frequency domain (UL)	100,00%	100,00%
	Time domain (UL)	100,00%	100,00%
Number of subscenarios		1	1
Duration of each subscenario		30 seconds	30 seconds
Comments		LTE signal modulation: QPSK (4QAM). Channel Bandwidth: 5 MHz	Wanted channel BW: 5 MHz. An adjacent channel is enabled. Interferer data: P interferer: -57 dBm. BW interferer: 5 MHz. FInterferer (offset): 5+0.0025 /-5-0.0025

13 Annex C: Reference Apps

Table 53 indicates the Reference Apps to be used for TRIANGLE certification testing:

Table 53 –Reference Apps

Use Case	Reference App
Virtual Reality	TBD
Gaming	TBD
Augmented Reality	TBD
Content Distribution Streaming Services	YouTube
Live Streaming Services	Periscope
Social Networking	Facebook
High Speed Internet	File Transfer (Android /iOS)
Patient Monitoring	TBD
Emergency Services	TBD

14 Annex D. Certification Scheme

14.1 Introduction

The primary objective of the TRIANGLE project is to promote the testing and benchmarking of mobile applications and devices as the industry moves towards 5G and to provide a pathway towards certification in order to support qualified apps and mobile developments using FIRE testbeds as testing framework.

TRIANGLE mark certification is based on performance testing.

Conformance testing, a testing performed by a Test System to verify the compliance of a product, according to certain standards, according to a Pass/Fail criteria, is not part of TRIANGLE certification. Devices undergoing TRIANGLE certification are expected to have been already certified according to industry main certification schemes, being the TRIANGLE objective, to benchmark the products according to their performance.

Interoperability testing is also not part of TRIANGLE certification.

The objective of this section is to define the certification scheme to be used to certify products according to TRIANGLE requirements.

The starting point to define this new certification scheme is to understand existing certification schemes for the products under the scope of the project. It is very important to understand the commonalities and differences and any possible overlap between the existing schemes.

The objective of TRIANGLE certification is to verify the performance of a mobile app or a device.

TRIANGLE certification consist on a set of test cases configured according to defined use cases and under specific test scenarios, that determine the performance of the device or application under test for a list of key performance indicators (KPIs).

The evaluation of the application or device performance is divided into domains. Each domain focuses on a special characteristic such as energy consumption or quality of experience.

The TRIANGLE mark provides a score for every domain evaluated in the application or device, as well as a global score. The mark's objective is to create a simple mobile applications and devices evaluation or scoring to provide final users a clear idea of that application or device behaviour.

The TRIANGLE mark allows that totally different applications or devices, being used in different use cases, can be assessed in an equivalent way, taking into account their performance in the domains specified by the TRIANGLE project.

14.2 What is under certification

TRIANGLE certification covers the products listed in this section.

14.2.1 Apps

An App is computer software, specifically developed to be used for mobile devices.

TRIANGLE certification program initially will only cover certification of Apps developed for Android and iOS operating systems.

Only apps that make use of 5G or pre-5G technology may obtain the TRIANGLE mark.

Apps will fall into one of the following use cases: virtual reality, gaming, augmented reality, content distribution streaming services, live streaming services, social networking, high speed internet, patient monitoring and emergency services. Nevertheless, additional use cases are expected to be added in the future.

Following software elements are not under the scope of TRIANGLE mark certification:

- PC Applications.
- Software running on servers.
- Applications that do not use 5G or pre-5G technologies.

14.2.2 Mobile devices

Mobile devices are computing devices, small enough to hold and operate in the hand. Mobile devices with Android and iOS operating systems can initially be certified to obtain the TRIANGLE mark. In the future other OS may also be supported.

Mobile devices must be able to run Android and iOS Apps (according to their OS).

Mobile devices will have a display screen and real or virtual keyboard.

Certifiable mobile devices must support 5G or pre-5G technology.

14.2.3 IoT devices

From TRIANGLE perspective, an IoT device is an electronic device, to be connected to other devices or systems through a 5G or pre-5G network.

An IoT device can operate to some extent interactively and autonomously.

In a first stage, following types of IoT devices can be certified to obtain TRIANGLE mark:

- IoT devices for smart metering and sensing/recording.
- IoT devices working in Smart Grids environment such as smart meters, smart appliances, etc.
- IoT devices to be used as part of Connected Vehicle systems.

14.3 Roles and Actors

The actors participating in the TRIANGLE mark certification process are:

14.3.1 Applicant

An applicant is any Application Developer, Device manufacturer, vendor, etc., requesting to obtain TRIANGLE mark for its product.

The applicant is responsible for:

- Creating TRIANGLE mark Certification Applications.
- Providing product documentation (including lists of features, supported use cases (ICS), IXIT, and any relevant applicant declaration.
- Selecting one Test Lab to perform testing.

- Providing Apps or, in the case of devices, required samples with ancillaries to the Test Lab to perform the testing.

14.3.2 3rd party Test Lab

Entity authorized by TRIANGLE to perform certification testing.

During the first two years after TRIANGLE mark is released, the Test Lab will not have any certification accreditation requirements. After this period, TRIANGLE Test Lab will need to be ISO 17025 accredited. This two years period will allow Test Labs start certification activities immediately and at the same time it will give enough time to labs to get required accreditation.

The 3rd party Test Lab (or just Test Lab) has the following responsibilities:

Test Plan generation: The Test Lab is responsible for producing the Test Plan (complete list of test cases to be performed to obtain certification) by means of using a TRIANGLE validated testbed, based on the product's features, supported use cases and scenarios (as provided by the applicant in the product's ICS statement.

Testing execution: The Test Lab performs testing by using a TRIANGLE validated testbed as technical evidence of TRIANGLE certification program.

Testing will be performed in a reliable, mature and repetitive way.

Test Report generation: The Test Lab issues a Test Report when all testing is completed.

Submission of documents: The Test Lab submits formally all testing evidences and any additional required document to the Certification Body for assessment.

Testbed maintenance: The Test Lab will hold and maintain TRIANGLE testbeds according to latest TRIANGLE requirements.

14.3.3 Certification Body

The Certification Body is an entity (person or group) with the following responsibilities:

- **Test Plan assessment**: The Certification Body assesses the certification Test Plan to verify that all the applicable test cases, and only those ones, are added to it.

- **Certification documentation assessment:** The Certification Body assesses the correctness and completeness of the product documentation submitted for certification.

- **Certification issues assessment**: The Certification Body will receive notifications from device vendors and Apps developers related to issues with TRIANGLE validated testbeds and/or TRIANGLE test specifications that may affect the certification of a product. The Certification Body will verify the existence of such issues and if they exist, it will take the required actions to get them solved. Issues with the testbed or Test Specifications will not delay the certification of a product.

- **Supply Certificate of Conformity** for products that have completed the TRIANGLE certification process and that have filled the certification requirements.

TRIANGLE will approve and designate individuals to take the Certification Body role. It is expected that Test Lab companies will propose one or more experts to become TRIANGLE certification bodies.

14.4 Types of certification

Following types of certification in the TRIANGLE certification program:

New Product

New Product Certification is the initial certification of a product.

Product Update

Product Update Certification is the certification of a new release of an already certified product. The newer release of the product has at least a modification of any of its software and/or hardware components.

Product Re-Branding Certification

Product Rebranding Certification is the certification of a product where the only changes from an already certified product are related to the branding of the product, including cosmetics changes of the product.

14.5 Types of testing

The primary objective of the TRIANGLE project is to promote the testing and benchmarking of mobile applications and devices as the industry moves towards 5G and to provide a pathway towards certification in order to support qualified apps and mobile developments using FIRE testbeds as testing framework.

TRIANGLE mark certification is based on performance testing.

Conformance testing, a testing performed by a Test System to verify the compliance of a product, according to certain standards, according to a Pass/Fail criteria, is not part of TRIANGLE certification. Devices undergoing TRIANGLE certification are expected to have been already certified according to industry main certification schemes, being the TRIANGLE objective, to benchmark the products according to their performance.

Interoperability testing is also not part of TRIANGLE certification.

14.5.1 Performance testing

The objective of TRIANGLE certification is to verify the performance of a mobile app or a device.

TRIANGLE certification consist on a set of test cases configured according to defined use cases and under specific test scenarios, that determine the performance of the device or application under test for a list of key performance indicators (KPIs).

The evaluation of the application or device performance is divided into domains. Each domain focuses on a special characteristic such as energy consumption or quality of experience.

The TRIANGLE mark provides a score for every domain evaluated in the application or device, as well as a global score. The mark's objective is to create a simple mobile applications and

devices evaluation or scoring to provide final users a clear idea of that application or device behaviour.

The TRIANGLE mark allows that totally different applications or devices, being used in different use cases, can be assessed in an equivalent way, taking into account their performance in the domains specified by the TRIANGLE project.

14.6   Processes

14.6.1 The certification process

TRIANGLE certification process starts when an applicant requests to certify a product by sending a filled certification application form to one of the approved TRIANGLE Certification Bodies.

The Certification Application Form is available in Annex E of this document.

The applicant will also select a Test Lab to perform the testing and as agreed with the Test Lab will send the required samples (in the case of device certification) or will provide the App for testing.

The selected Certification Body will be responsible for guiding the applicant through the whole certification process.

The applicant will send the Test Lab, all the required documentation to certify its product.

- Copy of the Certification Application Form.
- List of features, use cases and scenarios supported by the product (ICS tables).
- Product user manual or brief description explaining how to use the product for testing purposes.

The Test Lab will generate a Test Plan, i.e., the list of test cases to be executed to certify the product, according to the features supported by the product.

The Test Plan is obtained as the list of the product applicable test cases from the Test Case Reference List (TCRL), i.e. the complete list of test cases required by TRIANGLE for product certification.

The Certification Body will assess the Test Plan to verify its correctness and completeness.

Once the Test Plan is agreed, the Test Lab will start testing on it.

After finishing the execution of all the test cases in the Test Plan, the Test Lab will generate a Test Report where results of the testing are listed.

The Certification Body will assess the Test Report together with the testing evidences generated by the testbed and will verify whether all certification requirements are met.

When all certification requirements are met the Certification Body will issue the TRIANGLE mark for the product tested, completing the certification of the product.

The product information will be added to a list of TRIANGLE certified products.
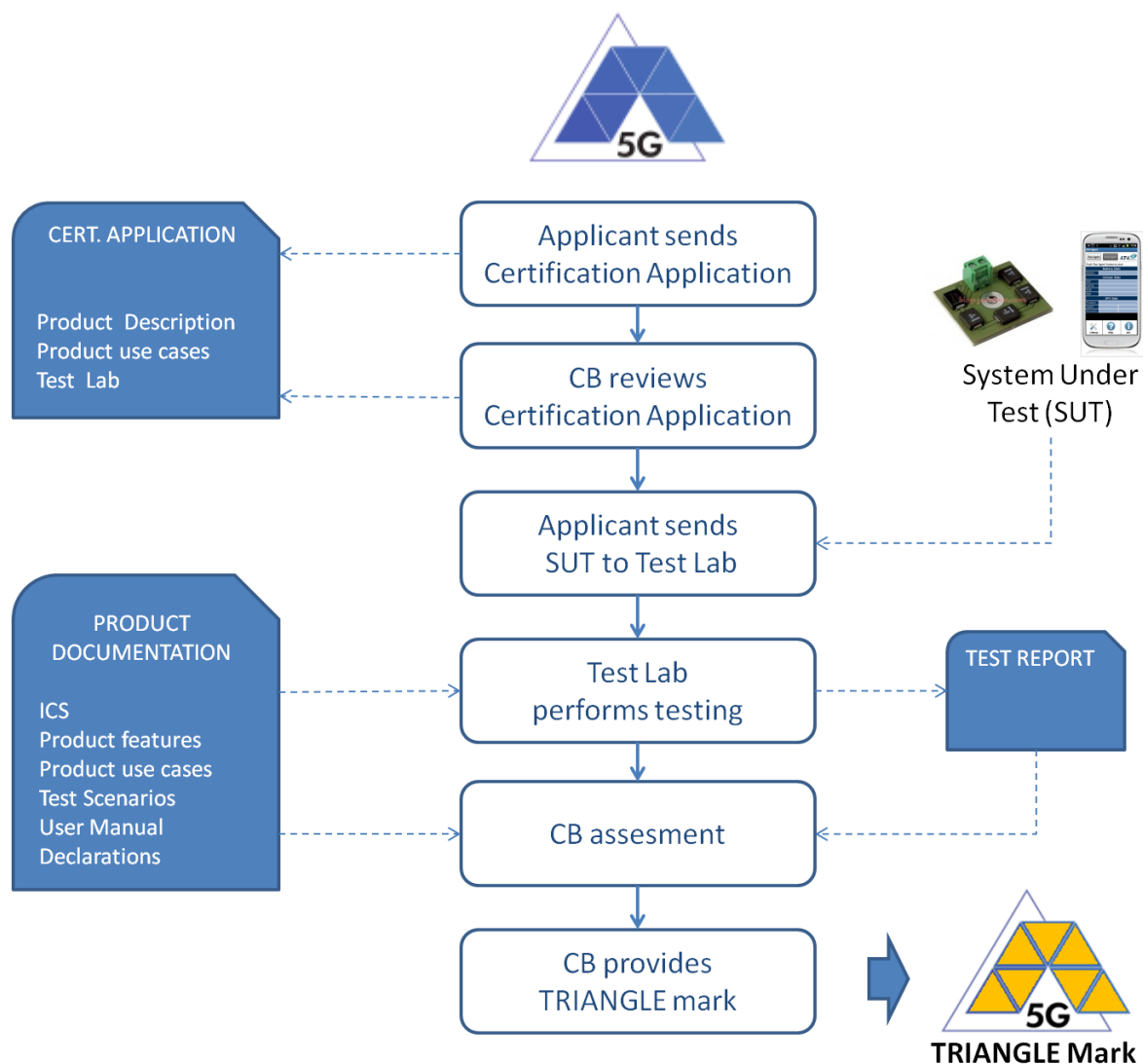
Figure 5 – TRIANGLE Certification process

14.6.2 Handling issues with TRIANGLE validated testbeds and TRIANGLE Test Specifications

During the certification process, it could happen that one (or more) of the certification requirements cannot be demonstrated due to a possible issue with one or more TRIANGLE validated testbed or with any of the TRIANGLE Test Specifications.

TRIANGLE defines a procedure to handle these issues and prevent that one of these issues stops or delays the certification process unnecessarily.

An Issue with the test specification happens when an applicant or Test Lab understands that the definition of a test case, or the test procedure defined to verify the test objective is not correct.

An issue with TRIANGLE validated testbed happens when the TRIANGLE testbed does not implement correctly or completely a test case as it is defined in the corresponding Test Specification.

Handling issues process

When an applicant or Test Lab identifies a possible Test Specification or TRIANGLE testbed issue, they will notify it to the Certification Body responsible for the certification process of the ongoing product certification.

In cases where an issue is identified, but it is not related to any product certification, the applicant or Test Lab may notify it to any of the TRIANGLE approved Certification Bodies.

The Certification Body will review the issue information and determine if the issue may be real. The CB will contact the TRIANGLE teams responsible of the Test Specifications definition and/or TRIANGLE testbed development team if it needs any clarification regarding the issue.

If it is agreed that the issue is real; the certification requirement may need to be removed totally or partially (if the issue only affects a restricted number of products or cases). If this is the case, the TRIANGLE Test Case Reference List (TCRL) will be updated accordingly.

The updated TCRL will become effective immediately.

The Certification Body will also start the required procedures to get the issue solved and, if possible, will get a time estimation for the implementation of the solution.

14.6.3 Certification Violations

TRIANGLE defines a process to handle possible certification violation.

The situations detailed below are identified as certification violations:

- A device vendor distributes a mobile device that does not have the TRIANGLE mark, but the vendor sells the product indicating it is TRIANGLE certified (e.g. using the TRIANGLE mark label.
- An App developer supplies an App including a TRIANGLE mark logo or any other reference to TRIANGLE mark without having certified the App.
- A device vendor or App developer supplies its certified product but showing a different global score and/or a domain score different from the product score obtained during product certification in the Test Lab.
- A device vendor or App developer makes changes to a certified product that affect the TRIANGLE mark certification requirements, and the device vendor or App developer does not certify the new version of the product.
- A device vendor provides samples or the App developer provides an App to the Test Lab for certification with one or more HW/SW changes compared to the product that is going to be commercialized and without informing the Certification Body.
- Product features, use cases and/or test scenarios (ICS tables) provided for certification do not match the product real information in order to ease or skip certification testing.

Identifying Violations

When an apparent certification violation is identified, it shall be notified to TRIANGLE.

The identifying party shall provide all the available details and documentation about the suspected certification violation. They identifying party may also provide comments about the impact caused by the certification violation from its point of view.

TRIANGLE (or an entity assigned by TRIANGLE, such as a Certification Body) shall assess the documentation. If TRIANGLE understands that there is rational evidence that a certification violation may be happening, TRIANGLE shall get in contact with the vendor/developer responsible of the apparent certification violation and will ask for clarification on the case.

After discussion with the vendor/developer, TRIANGLE will determine whether the certification violation is real or not, and will decide whether to place the offending OEM on probation for a

period of time. If TRIANGLE determines that the certification violation is real, it may decide to set the vendor/developer's product on probation.

A vendor/developer will not be responsible for certification violations due to the Test Lab or Certification Body errors or omissions when certifying its product.

Probation

TRIANGLE may audit products set on probation at its own discretion. The audit may include testing performed in a TRIANGLE Test Lab. The vendor/developer will be responsible for any cost consequence of the auditing activities and will pay for all those costs.

TRIANGLE may remove certifications of products that

- Fail to comply with certification requirements during the audit, or
- Obtain a global or any domain score significantly below the score obtained during certification.
- The vendor/developer does not allow performing product's audit or refuse to pay the audit's costs.

A product certification will be removed in any case, after three certification violations of that product.

Resolving Violations

Vendors will urgently stop the shipment of devices with a certification violation. Vendors will also provide a way to solve the certification violation.

App developers will stop immediately distributing their app and will remove or disable any location from where the app may be downloaded.

15 Annex E: TRIANGLE Mark Certification Application Form

PRODUCT INFORMATION:

Type of product	App/ Mobile device / IoT device
Product Name	
Software Version	
Description of the product	
Additional product info (url, etc)	
Supported Use Cases	

DEVICE ADDITIONAL INFORMATION:

Model Name	
Hardware Version	

COMPANY INFORMATION

OEM name	
Address	
City	
Postal Code	
State/Providence	
Country	

CONTACT INFORMATION

Name	
email	
Phone number	

SUPPORTED USE CASES

USE CASE	Support
Virtual Reality	Yes / No
Gaming	Yes / No
Augmented Reality	Yes / No
Content Distribution Streaming Services	Yes / No
Live Streaming Services	Yes / No
Social Networking	Yes / No
High Speed Internet	Yes / No
Patient Monitoring	Yes / No
Emergency Services	Yes / No
Smart Metering	Yes / No
Smart Grids	Yes / No
Connected Vehicles	Yes / No