

Definition of the Testing Framework for 5G Device Network Slicing Pre-commercial Trials

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DEFINITION OF THE TESTING FRAMEWORK FOR 5G DEVICE NETWORK SLICING PRE-COMMERCIAL TRIALS

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Abstract

The 5G network slicing can provide on-demand network slices to satisfy different service requirements. However, how to guarantee the network slicing service quality of 5G devices by the network slicing test based on the actual network elements is still a technical gap to be addressed.

Therefore, the fundamental purpose of this document is to provide a testing framework for 5G device network slicing pre-commercial trials based on the actual network elements, which include the test cases of the configuration and usage of NSSAI, UE route selection policy, interworking with EPC and other service specific network slicing test cases.

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1 INTRODUCTION

The NGMN Network Slicing for Operating Systems of 5G Smart Phones project was kicked off in 2020. After more than half a year of research and analysis, the “5G Smart Devices Supporting Network Slicing” White Paper [1] was published jointly with GTI in January 2021. Based on this White Paper, NGMN sends a Liaison to 3GPP RAN5 to stress the importance of the network slicing testing. Although a new Work Item on UE Conformance Test Aspects for Enhancement of Network Slicing and a new Study Item on 5G NR UE supporting Network Slicing Testing have been endorsed by RAN5, what is discussed and analysed in RAN5 is still the conformance test of network slicing by test equipment.

Some tests, such as network slicing tests based on the actual network elements, are not included in 3GPP RAN5. But these tests are still necessary to ensure the commercial success of network slicing. Furthermore, the industry has a demand for network slicing testing, and UE vendors and network providers are capable doing the network slicing test. Therefore, it is necessary to perform the network slicing testing in NGMN and GTI based on the actual network elements, which will provide valuable feedback and input to 3GPP and the industry.

The project focuses on the Network Slicing Trials based on the actual network elements, and has the following scope:

- Developing a testing framework for 5G Network Slicing Devices, which allows the harmonisation of the testing methodologies among different parties conducting trials;
- Testing 5G Network slicing capabilities by lab test/field trials with different kinds of devices, e.g. smartphones, modem;
- Consolidating the results from different industry players and drawing conclusions. Analysing the testing conclusions and bringing observations that could lead to future improvement.

The main purpose of the project is to assess the functionality and performance of Network Slicing implementation in 5G Devices based on Release 15 and forward of the 5G NR standardisation by lab test/field trials, so as to ensure the user experience.

2 SCOPE

This framework document is structured in three parts:

1. Trial setup requirements
2. Common requirements for network slicing trial
3. Service specific requirements for network slicing trial

The trial setup requirements section introduces the trial environment requirements, such as the network architecture and configuration, the test tool requirements, and the reporting requirements.

The common requirements for network slicing trial section define the test cases of network slicing in 5G devices, such as the configuration and usage of NSSAI, UE Route Selection Policy and Interworking with EPC. Each test case includes the test objective, pre-configuration, test procedure and success criteria.

The service specific requirements for network slicing trial section defines the service performance tests of network slicing in 5G devices, such as the video service, the cloud gaming service and FTP/speedtest download service. Each test case includes the test objective, pre-configuration, test procedure and success criteria for specific services.

3 TRIAL SETUP REQUIREMENTS

3.1 Network Architecture and Configuration

The pre-commercial network slicing trials will primarily aim at testing network slicing in 5G devices using actual network elements to reflect the functionality and performance of devices in a more realistic environment for more meaningful results.

The network slicing trials in this project are different from the 5G pre-commercial trials. The 5G pre-commercial trials focus on whether the performance parameters, such as latency, user throughput, cell capacity, and coverage, meet the requirements. The 5G device network slicing trials in this project focus on the signalling aspect and whether the network and device can successfully deal with the configuration of NSSAI, the UE route selection policy and the interworking with EPC. The deployment scenarios are not main considerations in this version of the document and need to be determined according to the actual test environment.

The 5G device network slicing trial is an end-to-end test. The test environment requires the cells/sites, core network, UEs and signalling analysis tools. The site needs to be a 5G NR site so that the UE can access the core network through this NR site. The core network should be a 5G core network, and its network elements -- AMF, SMF, PCF, NSSF and others need to have the ability to support network slicing (which is mandatory per 3GPP Rel-15 specifications).

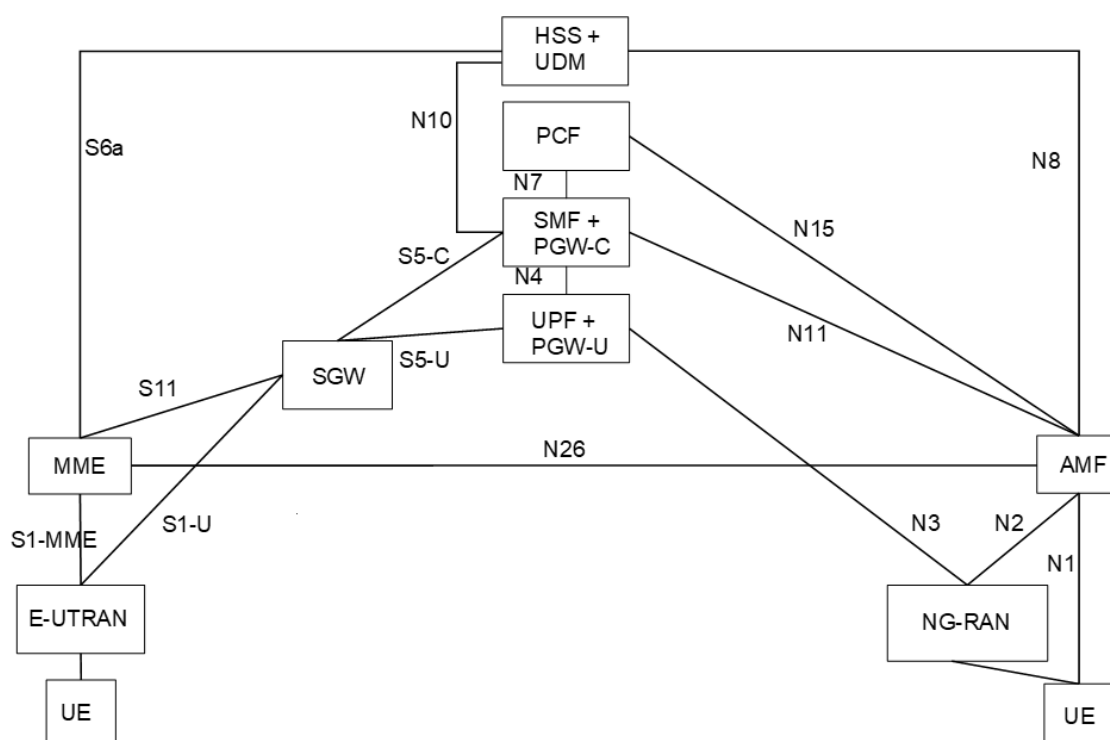


Figure 1: Overall Architecture

Note: For more details, please see [2].

The UEs used in this trial are test UEs, not commercial UEs. For this trial, the test UEs include the smart UEs and non-smart UEs. The smart UEs include the smartphones and other devices with operating systems, while the non-smart UEs include the Modem and CPEs.

Table 1: Test Environment Requirements

Test Environment Requirements	Test Environment Setup	Notes
Cells/Sites	At least two sites	These sites should include one site for NR and one site for LTE.

Network elements	NSSF	The 5G core network should have the ability to support network slicing feature. If not, the related network elements of 5G core network should be updated to the version which supports the network slicing feature.
	SMF	
	PCF	
	AMF	
	UDM	

The requirement of the number of cells/sites will vary in different test cases. For test cases related to NSSAI and URSP scenarios, one NR site is sufficient. For test cases related to interworking with EPC, at least two sites are required, i.e. one for NR and one for LTE.

3.2 Test Tool Requirements

In order to observe whether the UE can successfully handle the configuration of NSSAI, the UE route selection policy and the interworking with EPC for signalling aspects, this test requires the vendors to provide appropriate signalling analysis tools to analyse NAS layer signalling, and an appropriate tool to simulate APPs or real APP.

Table 2: Test Tool Requirements

Tools	Logical Network Element Name	Numbers	Notes
Application	APP	At least two for each UE	An appropriate tool to simulate APPs or real APP
Analysis tool	Analysis tool	one	Analyse NAS layer signalling message.
Network performance test tool	Iperf	one	Simulating an overloaded network

3.3 Test Report Requirements

The trial reporting is a very important phase for the trial. In order to provide analytically valuable test results, it is necessary to provide a benchmark for the test cases for the comparison of test results. Hence, contributors are encouraged to provide as many details as possible about their trials. The following aspects need to be covered in the trial reporting.

1. Trial setup information

The following deployment parameters need to be reported for each trial:

- Frequency band
 - Operating bandwidth
 - Number of sites
 - Type of test UEs (smartphones, modem, CPE...)
 - Network elements (RAN, core network.....)
 -
2. Trial result information
Contributors are required to provide test results related information, including test log, test results analysis, etc.
3. Trial result benchmark
Defining the benchmarks to evaluate the performance of 5G network slicing is very crucial.
For the network slicing signalling test, using 5G NR Rel.15 as a benchmark is an option. For the network slicing performance test, the benchmark is the performance of the same kind of application without network slicing. Ideally, the benchmark is based on the same test environment/condition, such as the benchmark application has the same setup parameters and the same test environment with the test application. The only difference is that the test application is implemented in the specific network slice according to the UE subscription, while the benchmark application is implemented in the default network slice. However, the different test environment/condition between benchmark and test application could also be acceptable as long as the differences are well described.

4 COMMON REQUIREMENTS FOR NETWORK SLICING TRIAL

4.1 The Configuration and Usage of NSSAI

4.1.1 NSSAI Handling in Initial Registration

4.1.1.1 Test Objective

The purpose of this test case is to verify the UE can successfully perform the initial registration to the 5G system without/with Requested NSSAI and support of Configured NSSAI/Allowed NSSAI/Rejected NSSAI for network slicing.

4.1.1.2 Pre-configuration

NW:

- 5GC Cell A belongs to Home PLMN;
- Subscribed S-NSSAIs are configured for UE, the Configured NSSAI (including S-NSSAI1, S-NSSAI2 and S-NSSAI3) can be generated for UE.

UE:

- The test UICC with USIM should be inserted;
- UE has no stored allowed NSSAI for the current PLMN, no configured NSSAI for the current PLMN, and no default configured NSSAI;
- The UE is in state Switched OFF.

4.1.1.3 Test Procedure

1. Switch on UE;
2. The UE sends a REGISTRATION REQUEST message to initiate the registration procedure;
3. The NW sends a REGISTRATION ACCEPT message including Configured NSSAI;
4. Switch off UE;
5. From network side, remove S-NSSAI-3 from the UE's subscription information in the UDM, so that the Allowed NSSAI (S-NSSAI1 and S-NSSAI2) and the Rejected NSSAI (S-NSSAI3) can be generated for the UE in this registration area;
6. Switch on UE;
7. The UE sends a REGISTRATION REQUEST message to initiate the registration procedure;
8. The NW sends a REGISTRATION ACCEPT message including Allowed NSSAI and Rejected NSSAI;
9. Use MMI/AT command (+C5GNSSAIRDP) or other method to verify the Allowed NSSAI and Rejected NSSAI stored in UE;
10. Switch off UE, then switch on UE;
11. The UE sends a REGISTRATION REQUEST message to initiate the registration procedure.

Table 3: Main Message Flow for NSSAI Handling in Initial Registration

Step	Direction UE - NW	Message	Comments
2	-->	REGISTRATION REQUEST	Registration type "initial registration" NOT including Requested NSSAI

3	<--	REGISTRATION ACCEPT	Including Configured NSSAI (S-NSSAI1, S-NSSAI2 and S-NSSAI3)
7	-->	REGISTRATION REQUEST	Registration type "initial registration"; including Requested NSSAI
8	<--	REGISTRATION ACCEPT	Including Allowed NSSAI (S-NSSAI1 and S-NSSAI2), Configured NSSAI (S-NSSAI1, S-NSSAI2) and Rejected NSSAI (S-NSSAI3)
11	-->	REGISTRATION REQUEST	Registration type "initial registration"; including Requested NSSAI

Note: The Allowed NSSAI is the intersection of the requested NSSAI, the NSSAI supported by the AMF, the NSSAI supported by the RAN, and the NSSAI subscribed by the UE.

4.1.1.4 Success Criteria

Step 2: UE performs initial registration without Requested NSSAI;

Step 7: UE performs initial registration with Requested NSSAI, which including the S-NSSAI(s) from the configured NSSAI (e.g. S-NSSAI1, S-NSSAI2 and S-NSSAI3);

Step 9: UE correctly stores the latest Allowed NSSAI (S-NSSAI1 and S-NSSAI2), Configured NSSAI (S-NSSAI1, S-NSSAI2) and Rejected NSSAI (S-NSSAI3);

Step 11: UE performs initial registration with Requested NSSAI, which including the S-NSSAI(s) from the allowed NSSAI (e.g. S-NSSAI1 and S-NSSAI2).

4.1.2 NSSAI Handling during Mobility Registration Update

4.1.2.1 Test Objective

The purpose of this test case is to verify the UE can successfully perform Mobility Registration Update procedure after reselecting a cell in a new Tracking Area outside its Registration Area, and the UE shall include the requested NSSAI containing the S-NSSAI(s) corresponding to the slices to which the UE intends to register.

4.1.2.2 Pre-configuration

NW:

- 2 cells, 5GC Cell A and 5GC Cell B belonging to the same Home PLMN but different RA;

- Subscribed S-NSSAIs are configured for UE, Allowed NSSAI (including S-NSSAI1, S-NSSAI2 and S-NSSAI3) and Configured NSSAI (including S-NSSAI1, S-NSSAI2 and S-NSSAI3) can be generated for UE.

UE:

- The test UICC with USIM should be inserted;
- The UE is in state Switched OFF.

4.1.2.3 Test Procedure

1. Only Cell A is ON, then switch on UE;
2. The UE sends a REGISTRATION REQUEST message to initiate the registration procedure on Cell A;
3. The NW sends a REGISTRATION ACCEPT message including Allowed NSSAI and Configured NSSAI;
4. Cell B is ON, and let UE move from the service area of Cell A to Cell B;
5. The UE sends a REGISTRATION REQUEST message for mobility registration update on Cell B.

Table 4: Main Message Flow for NSSAI Handling during Mobility Registration Update

Step	Direction UE - NW	Message	Comments
2	-->	REGISTRATION REQUEST	Registration type "initial registration"
3	<--	REGISTRATION ACCEPT	Including Allowed NSSAI (S-NSSAI1, S-NSSAI2 and S-NSSAI3) and Configured NSSAI (S-NSSAI1, S-NSSAI2 and S-NSSAI3)
5	-->	REGISTRATION REQUEST	Registration type "mobility registration updating"; including Requested NSSAI

4.1.2.4 Success Criteria

Step 5: UE performs registration procedure for mobility registration update with Requested NSSAI, which including the S-NSSAI(s) from the allowed NSSAI and configured NSSAI (e.g. S-NSSAI1, S-NSSAI2 and S-NSSAI3).

4.1.3 Default Configured NSSAI Pre-configuration and Update

4.1.3.1 Test Objective

The purpose of this test case is to verify the UE can transmit REGISTRATION REQUEST message with Requested NSSAI using the default configured NSSAI and also include Network slicing indication, while the default configured NSSAI can be pre-configured in UE and updated by NW.

4.1.3.2 Pre-configuration

NW:

- 5GC Cell A belongs to Home PLMN;
- No Subscribed S-NSSAI configured for UE.

UE:

- UE has no stored allowed NSSAI for the current PLMN, no configured NSSAI for the current PLMN, and no default configured NSSAI;
- The UE is in state Switched OFF.

4.1.3.3 Test Procedure

1. Switch on UE;
2. Via AT command or other method, UE is preconfigured with Default Configured NSSAI as S-NSSAI1 and S-NSSAI2, then switch off UE;
3. From network side, configure Subscribed S-NSSAIs for UE, so that the Allowed NSSAI (including S-NSSAI1, S-NSSAI2 and S-NSSAI3) and Configured NSSAI (including S-NSSAI1, S-NSSAI2 and S-NSSAI3) can be generated for UE;
4. Switch on UE;
5. The UE sends a REGISTRATION REQUEST message to initiate the registration procedure;
6. The NW sends a REGISTRATION ACCEPT message including Allowed NSSAI and Configured NSSAI;
7. From network side, triggers the UE Parameter Update via UDM Control Plan procedure, to re-configure the default configured NSSAI as S-NSSAI1 and S-NSSAI3;
8. The UE acknowledgement of successful reception of the updated UE configuration parameter information is sent back to the network using the UE-initiated uplink NAS transport procedure;
9. Use MMI/AT command (+C5GNSSAIRDP) or other method to verify the update of the Default Configured NSSAI stored in UE.

Table 5: Main Message Flow for Default Configured NSSAI Pre-configuration and Update

Step	Direction UE - NW	Message	Comments
5	-->	REGISTRATION REQUEST	Registration type "initial registration"; Requested NSSAI =S-NSSAI1, S-NSSAI2; network slicing indication-->Default configured NSSAI indication (DCNI) bit=1
6	<--	REGISTRATION ACCEPT	Including Allowed NSSAI (S-NSSAI1, S-NSSAI2 and Configured NSSAI (S-NSSAI1, S-NSSAI2 and S-NSSAI3)
7	<--	DL NAS transport	Payload container type =0 1 1 0 (i.e. UE parameters update transparent container); UE parameters update data type="0"; Acknowledgement (ACK) value = 1 (acknowledgement requested); UE parameters update data set type= 0010 (Default configured NSSAI update data); default configured NSSAI=S-NSSAI1, S-NSSAI3
8	-->	UL NAS transport	Payload container type =0 1 1 0 (i.e. UE parameters update transparent container); UE parameters update data type="1"

4.1.3.4 Success Criteria

Step 5: UE sends REGISTRATION REQUEST message with Requested NSSAI using the default configured NSSAI (S-NSSAI1, S-NSSAI2) and also includes Network slicing indication;

Step 9: The Default Configured NSSAI stored in UE is updated successfully, i.e. S-NSSAI1 and S-NSSAI3.

4.1.4 Generic UE Configuration Update for NSSAI

4.1.4.1 Test Objective

The purpose of this test case is to verify the UE supports the generic UE configuration update procedure initiated by the network to update Configured NSSAI/Allowed NSSAI/rejected NSSAI.

4.1.4.2 Pre-configuration

NW:

- 5GC Cell A belongs to Home PLMN;
- Subscribed S-NSSAIs are configured for UE, Allowed NSSAI (including S-NSSAI1, S-NSSAI2 and S-NSSAI3) and Configured NSSAI (including S-NSSAI1, S-NSSAI2 and S-NSSAI3) can be generated for UE.

UE:

- The test UICC with USIM should be inserted;
- The UE is in state Switched OFF.

4.1.4.3 Test Procedure

1. Switch on UE;
2. The UE sends a REGISTRATION REQUEST message to initiate the registration procedure;
3. The NW sends a REGISTRATION ACCEPT message including Allowed NSSAI and Configured NSSAI;
4. From network side, initiates the Generic UE configuration update procedure, to update the UE with the new Configured NSSAI, Allowed NSSAI;
5. The UE sends a CONFIGURATION UPDATE COMPLETE message;
6. Use MMI/AT command (+C5GNSSAIRDP) or other method to verify the update of allowed NSSAI and rejected NSSAI.

Table 6: Main Message Flow for Generic UE Configuration Update for NSSAI

Step	Direction UE - NW	Message	Comments
2	-->	REGISTRATION REQUEST	Registration type "initial registration"

3	<--	REGISTRATION ACCEPT	including Allowed NSSAI (S-NSSAI1, S-NSSAI2 and S-NSSAI3) and Configured NSSAI (S-NSSAI1, S-NSSAI2 and S-NSSAI3)
4	<--	CONFIGURATION UPDATE COMMAND	Including Allowed NSSAI (S-NSSAI1, S-NSSAI2), Configured NSSAI (S-NSSAI1, S-NSSAI2) and Rejected NSSAI (S-NSSAI3); Configuration update indication--> Acknowledgement (ACK) value=1
5	-->	CONFIGURATION UPDATE COMPLETE	

4.1.4.4 Success Criteria

Step 5: UE sends a confirmation response "CONFIGURATION UPDATE COMPLETE" to NW;

Step 6: UE correctly stores the updated Allowed NSSAI (S-NSSAI1 and S-NSSAI2), Configured NSSAI (S-NSSAI1, S-NSSAI2) and Rejected NSSAI(S-NSSAI3).

4.1.5 NSSAI Inclusion Mode A

4.1.5.1 Test Objective

The purpose of this test case is to verify the UE supports NSSAI inclusion mode A indicated by NW.

4.1.5.2 Pre-configuration

NW:

- 5GC Cell A belongs to Home PLMN;
- Subscribed S-NSSAIs are configured for UE, Allowed NSSAI (including S-NSSAI1, S-NSSAI2, S-NSSAI3, S-NSSAI4, S-NSSAI5 and S-NSSAI6) and Configured NSSAI (including S-NSSAI1, S-NSSAI2, S-NSSAI3, S-NSSAI4, S-NSSAI5 and S-NSSAI6) can be generated for UE;
- Set the periodic registration update timer (T3512) to the minimum value.

UE:

- The test UICC with USIM should be inserted;
- The UE is in state Switched OFF.

4.1.5.3 Test Procedure

1. Switch on UE;
2. The UE sends a REGISTRATION REQUEST message to initiate the registration procedure;
3. The NW sends a REGISTRATION ACCEPT message including Allowed NSSAI and Configured NSSAI, and the NSSAI inclusion mode IE is set to "NSSAI inclusion mode A";
4. Switch off UE, then Switch on UE;
5. The UE sends a REGISTRATION REQUEST message to initiate the registration procedure, check the s-NSSAI-List in RRCSetupComplete message;
6. The NW sends a REGISTRATION ACCEPT message;
7. From network side, initiates a generic UE configuration update procedure by sending the CONFIGURATION UPDATE COMMAND to the UE with a request to perform the registration procedure;
8. The UE sends a CONFIGURATION UPDATE COMPLETE message;
9. Wait for NW releasing the existing N1 NAS signalling connection;
10. The UE sends a REGISTRATION REQUEST message for mobility registration update, check the s-NSSAI-List in RRCSetupComplete message;
11. The NW sends a REGISTRATION ACCEPT message;
12. Wait for NW releasing the RRC connection due to user inactivity, UE is in 5GMM-IDLE mode;
13. Use setting menu or engineering mode or other method to change UE radio capability for NG-RAN, e.g. change the 5G mode from SA mode to SA+NSA mode, to trigger UE initiate the registration procedure for mobility registration update by sending a REGISTRATION REQUEST message, check the s-NSSAI-List in RRCSetupComplete message;
14. The NW sends a REGISTRATION ACCEPT message;
15. Wait for the periodic registration update timer (T3512) to expire, UE sends a REGISTRATION REQUEST message for periodic registration update, check the s-NSSAI-List in RRCSetupComplete message;
16. The NW sends a REGISTRATION ACCEPT message;
17. Initiate data transfer (Ping) on internet DNN, with the PDU session established on the default network slice (e.g. S-NSSAI1);
18. Stop any data transfer, wait for NW releasing the RRC connection due to user inactivity;
19. Initiate data transfer (Ping) on internet DNN, UE sends a SERVICE REQUEST message, check the s-NSSAI-List in RRCSetupComplete message.

Table 7: Main Message Flow for NSSAI Inclusion Mode A

Step	Direction UE - NW	Message	Comments
2	-->	NAS: REGISTRATION REQUEST	Registration type "initial registration"
3	<--	NAS: REGISTRATION ACCEPT	Including Allowed NSSAI (S-NSSAI1, S-NSSAI2, S-NSSAI3, S-NSSAI4, S-NSSAI5 and S-NSSAI6) and Configured NSSAI (S-NSSAI1, S-NSSAI2, S-NSSAI3, S-NSSAI4, S-NSSAI5 and S-NSSAI6); NSSAI inclusion mode=00 (i.e. NSSAI inclusion mode A)
5	-->	RRC: RRCRequest	
	<--	RRC: RRCSetup	
	-->	RRC: RRCSetupComplete NAS: REGISTRATION REQUEST	In RRCSetupComplete message, the s-NSSAI-List including the S-NSSAIs of Requested NSSAI; in REGISTRATION REQUEST message, Registration type is "initial registration"
6	<--	NAS: REGISTRATION ACCEPT	Including Allowed NSSAI (S-NSSAI1, S-NSSAI2, S-NSSAI3, S-NSSAI4, S-NSSAI5 and S-NSSAI6) and Configured NSSAI (S-NSSAI1, S-NSSAI2, S-NSSAI3, S-NSSAI4, S-NSSAI5 and S-NSSAI6); NSSAI inclusion mode=00 (i.e. NSSAI inclusion mode A)
7	<--	NAS: CONFIGURATION UPDATE COMMAND	Including Allowed NSSAI (S-NSSAI1, S-NSSAI2, S-NSSAI3, S-NSSAI4 and S-NSSAI5), Configured NSSAI (S-NSSAI1, S-NSSAI2, S-NSSAI3, S-NSSAI4 and S-NSSAI5) and Rejected NSSAI(S-NSSAI6);

			Configuration update indication--> Registration requested (RED) value=1 and Acknowledgement (ACK) value=1
8		NAS: CONFIGURATION UPDATE COMPLETE	
10	-->	RRC: RRCRequest	
	<--	RRC: RRCSetup	
	-->	RRC: RRCSetupComplete NAS: REGISTRATION REQUEST	In RRCSetupComplete message, the s-NSSAI-List including the S-NSSAIs of Requested NSSAI; in REGISTRATION REQUEST message, Registration type is "mobility registration updating"
11	<--	NAS: REGISTRATION ACCEPT	Including Allowed NSSAI (S-NSSAI1, S-NSSAI2, S-NSSAI3 and S-NSSAI4); NSSAI inclusion mode=00 (i.e. NSSAI inclusion mode A)
13	-->	RRC: RRCRequest	
	<--	RRC: RRCSetup	
	-->	RRC: RRCSetupComplete NAS: REGISTRATION REQUEST	In RRCSetupComplete message, the s-NSSAI-List including the S-NSSAIs of Allowed NSSAI; in REGISTRATION REQUEST message, Registration type is "mobility registration updating", and 5GS update type is "NG-RAN radio capability update needed"
14	<--	NAS:REGISTRATION ACCEPT	Including Allowed NSSAI (S-NSSAI1, S-NSSAI2 and S-NSSAI3); NSSAI inclusion mode=00 (i.e. NSSAI inclusion mode A)
15	-->	RRC: RRCRequest	

	<--	RRC: RRCSetup	
	-->	RRC: RRCSetupComplete NAS: REGISTRATION REQUEST	In RRCSetupComplete message, the s-NSSAI-List including the S-NSSAIs of Allowed NSSAI; in REGISTRATION REQUEST message, Registration type is "periodic registration updating"
16	<--	NAS: REGISTRATION ACCEPT	Including Allowed NSSAI(S-NSSAI1,S-NSSAI2); NSSAI inclusion mode=00 (i.e. NSSAI inclusion mode A)
19	-->	RRC: RRCRequest	
	<--	RRC: RRCSetup	
	-->	RRC: RRCSetupComplete NAS: SERVICE REQUEST	In RRCSetupComplete message, the s-NSSAI-List including the S-NSSAIs of Allowed NSSAI

4.1.5.4 Success Criteria

Step 5: UE includes the NSSAI set to the Requested NSSAI in the Access Stratum Connection Establishment caused by the Initial Registration;

Step 10: UE includes the NSSAI set to the Requested NSSAI in the Access Stratum Connection Establishment caused by the Mobility Registration Update;

Step 13: UE includes the NSSAI set to the Allowed NSSAI (received in Registration Accept in step 11) in the Access Stratum Connection Establishment caused by the Registration procedure used to update the UE capabilities;

Step 15: UE includes the NSSAI set to the Allowed NSSAI (received in Registration Accept in step 14) in the Access Stratum Connection Establishment caused by the Periodic Registration Update;

Step 19: UE includes the NSSAI set to the Allowed NSSAI (received in Registration Accept in step 16) in the Access Stratum Connection Establishment caused by the Service Request.

4.1.6 NSSAI Inclusion Mode B

4.1.6.1 Test Objective

The purpose of this test case is to verify the UE supports NSSAI inclusion mode B indicated by NW.

4.1.6.2 Pre-configuration

NW:

- 5GC Cell A belongs to Home PLMN;
- Subscribed S-NSSAIs are configured for UE, Allowed NSSAI (including S-NSSAI1, S-NSSAI2, S-NSSAI3, S-NSSAI4, S-NSSAI5 and S-NSSAI6) and Configured NSSAI (including S-NSSAI1, S-NSSAI2, S-NSSAI3, S-NSSAI4, S-NSSAI5 and S-NSSAI6) can be generated for UE;
- Set the periodic registration update timer(T3512) to the minimum value.

UE:

- The test UICC with USIM should be inserted;
- The UE is in state Switched OFF.

4.1.6.3 Test Procedure

1. Switch on UE;
2. The UE sends a REGISTRATION REQUEST message to initiate the registration procedure;
3. The NW sends a REGISTRATION ACCEPT message including Allowed NSSAI and Configured NSSAI, and the NSSAI inclusion mode IE is set to "NSSAI inclusion mode B";
4. Switch off UE, then Switch on UE;
5. The UE sends a REGISTRATION REQUEST message to initiate the registration procedure, check the s-NSSAI-List in RRCSetupComplete message;
6. The NW sends a REGISTRATION ACCEPT message;
7. From network side, initiates a generic UE configuration update procedure by sending the CONFIGURATION UPDATE COMMAND to the UE with a request to perform the registration procedure;
8. The UE sends a CONFIGURATION UPDATE COMPLETE message;
9. Wait for NW releasing the existing N1 NAS signalling connection;
10. The UE sends a REGISTRATION REQUEST message for mobility registration update, check the s-NSSAI-List in RRCSetupComplete message;
11. The NW sends a REGISTRATION ACCEPT message;

12. Wait for NW releasing the RRC connection due to user inactivity, UE is in 5GMM-IDLE mode;
13. Use setting menu or engineering mode or other method to change UE radio capability for NG-RAN, e.g. change the 5G mode from SA mode to SA+NSA mode, to trigger UE initiate the registration procedure for mobility registration update by sending a REGISTRATION REQUEST message, check the s-NSSAI-List in RRCSetupComplete message;
14. The NW sends a REGISTRATION ACCEPT message;
15. Wait for the periodic registration update timer (T3512) to expire, UE sends a REGISTRATION REQUEST message for periodic registration update, check the s-NSSAI-List in RRCSetupComplete message;
16. The NW sends a REGISTRATION ACCEPT message;
17. Initiate data transfer (Ping) on internet DNN, with the PDU session established on the default network slice (e.g. S-NSSAI1);
18. Stop any data transfer, wait for NW releasing the RRC connection due to user inactivity;
19. Initiate data transfer (Ping) on internet DNN, UE sends a SERVICE REQUEST message, check the s-NSSAI-List in RRCSetupComplete message.

Table 8: Main Message Flow for NSSAI Inclusion Mode B

Step	Direction UE - NW	Message	Comments
2	-->	NAS: REGISTRATION REQUEST	Registration type "initial registration"
3	<--	NAS: REGISTRATION ACCEPT	Including Allowed NSSAI (S-NSSAI1, S-NSSAI2, S-NSSAI3, S-NSSAI4, S-NSSAI5 and S-NSSAI6) and Configured NSSAI (S-NSSAI1, S-NSSAI2, S-NSSAI3, S-NSSAI4, S-NSSAI5 and S-NSSAI6); NSSAI inclusion mode=01 (i.e. NSSAI inclusion mode B)
5	-->	RRC: RRCRequest	
	<--	RRC: RRCSetup	
	-->	RRC: RRCSetupComplete NAS: REGISTRATION REQUEST	In RRCSetupComplete message, the s-NSSAI-List including the S-NSSAIs of Requested NSSAI;

			in REGISTRATION REQUEST message, Registration type is "initial registration"
6	<--	NAS: REGISTRATION ACCEPT	Including Allowed NSSAI (S-NSSAI1, S-NSSAI2, S-NSSAI3, S-NSSAI4, S-NSSAI5 and S-NSSAI6) and Configured NSSAI (S-NSSAI1, S-NSSAI2, S-NSSAI3, S-NSSAI4, S-NSSAI5 and S-NSSAI6); NSSAI inclusion mode=01 (i.e. NSSAI inclusion mode B)
7	<--	NAS: CONFIGURATION UPDATE COMMAND	Including Allowed NSSAI (S-NSSAI1, S-NSSAI2, S-NSSAI3, S-NSSAI4 and S-NSSAI5), Configured NSSAI (S-NSSAI1, S-NSSAI2, S-NSSAI3, S-NSSAI4 and S-NSSAI5) and Rejected NSSAI (S-NSSAI6); Configuration update indication--> Registration requested (RED) value=1 and Acknowledgement (ACK) value=1
8		NAS: CONFIGURATION UPDATE COMPLETE	
10	-->	RRC: RRCRequest	
	<--	RRC: RRCSetup	
	-->	RRC: RRCSetupComplete NAS: REGISTRATION REQUEST	In RRCSetupComplete message, the s-NSSAI-List including the S-NSSAIs of Requested NSSAI; in REGISTRATION REQUEST message, Registration type is "mobility registration updating"
11	<--	NAS: REGISTRATION ACCEPT	Including Allowed NSSAI (S-NSSAI1, S-NSSAI2, S-NSSAI3 and S-NSSAI4);

			NSSAI inclusion mode=01 (i.e. NSSAI inclusion mode B)
13	-->	RRC: RRCRequest	
	<--	RRC: RRCSetup	
	-->	RRC: RRCSetupComplete NAS: REGISTRATION REQUEST	In RRCSetupComplete message, the s-NSSAI-List including the S-NSSAIs of Allowed NSSAI; in REGISTRATION REQUEST message, Registration type is "mobility registration updating", and 5GS update type is "NG-RAN radio capability update needed"
14	<--	NAS:REGISTRATION ACCEPT	Including Allowed NSSAI (S-NSSAI1, S-NSSAI2 and S-NSSAI3); NSSAI inclusion mode=01 (i.e. NSSAI inclusion mode B)
15	-->	RRC: RRCRequest	
	<--	RRC: RRCSetup	
	-->	RRC: RRCSetupComplete NAS: REGISTRATION REQUEST	In RRCSetupComplete message, the s-NSSAI-List including the S-NSSAIs of Allowed NSSAI; in REGISTRATION REQUEST message, Registration type is "periodic registration updating"
16	<--	NAS: REGISTRATION ACCEPT	Including Allowed NSSAI (S-NSSAI1, S-NSSAI2); NSSAI inclusion mode=01 (i.e. NSSAI inclusion mode B)
19	-->	RRC: RRCRequest	
	<--	RRC: RRCSetup	
	-->	RRC: RRCSetupComplete NAS: SERVICE REQUEST	In RRCSetupComplete message, the s-NSSAI-List including S-NSSAI1

4.1.6.4 Success Criteria

Step 5: UE includes the NSSAI set to the Requested NSSAI in the Access Stratum Connection Establishment caused by the Initial Registration;

Step 10: UE includes the NSSAI set to the Requested NSSAI in the Access Stratum Connection Establishment caused by the Mobility Registration Update;

Step 13: UE includes the NSSAI set to the Allowed NSSAI (received in Registration Accept in step 11) in the Access Stratum Connection Establishment caused by the Registration procedure used to update the UE capabilities;

Step 15: UE includes the NSSAI set to the Allowed NSSAI (received in Registration Accept in step 14) in the Access Stratum Connection Establishment caused by the Periodic Registration Update;

Step 19: UE includes the NSSAI set to S-NSSAI of the PDU sessions that have the User Plane reactivated by the Service Request in the Access Stratum Connection Establishment caused by the Service Request.

4.1.7 NSSAI Inclusion Mode C

4.1.7.1 Test Objective

The purpose of this test case is to verify the UE supports NSSAI inclusion mode C indicated by NW.

4.1.7.2 Pre-configuration

NW:

- 5GC Cell A belongs to Home PLMN;
- Subscribed S-NSSAIs are configured for UE, Allowed NSSAI (including S-NSSAI1, S-NSSAI2, S-NSSAI3, S-NSSAI4, S-NSSAI5 and S-NSSAI6) and Configured NSSAI (including S-NSSAI1, S-NSSAI2, S-NSSAI3, S-NSSAI4, S-NSSAI5 and S-NSSAI6) can be generated for UE;
- Set the periodic registration update timer(T3512) to the minimum value.

UE:

- The test UICC with USIM should be inserted;
- The UE is in state Switched OFF.

4.1.7.3 Test Procedure

1. Switch on UE;
2. The UE sends a REGISTRATION REQUEST message to initiate the registration procedure;
3. The NW sends a REGISTRATION ACCEPT message including Allowed NSSAI and Configured NSSAI, and the NSSAI inclusion mode IE is set to "NSSAI inclusion mode C";
4. Switch off UE, then Switch on UE;
5. The UE sends a REGISTRATION REQUEST message to initiate the registration procedure, check the s-NSSAI-List in RRCSetupComplete message;
6. The NW sends a REGISTRATION ACCEPT message;
7. From network side, initiates a generic UE configuration update procedure by sending the CONFIGURATION UPDATE COMMAND to the UE with a request to perform the registration procedure;
8. The UE sends a CONFIGURATION UPDATE COMPLETE message;
9. Wait for NW releasing the existing N1 NAS signalling connection;
10. The UE sends a REGISTRATION REQUEST message for mobility registration update, check the s-NSSAI-List in RRCSetupComplete message;
11. The NW sends a REGISTRATION ACCEPT message;
12. Wait for NW releasing the RRC connection due to user inactivity, UE is in 5GMM-IDLE mode;
13. Use setting menu or engineering mode or other method to change UE radio capability for NG-RAN, e.g. change the 5G mode from SA mode to SA+NSA mode, to trigger UE initiate the registration procedure for mobility registration update by sending a REGISTRATION REQUEST message, check the s-NSSAI-List in RRCSetupComplete message;
14. The NW sends a REGISTRATION ACCEPT message;
15. Wait for the periodic registration update timer (T3512) to expire, UE sends a REGISTRATION REQUEST message for periodic registration update, check the s-NSSAI-List in RRCSetupComplete message;
16. The NW sends a REGISTRATION ACCEPT message;
17. Initiate data transfer (Ping) on internet DNN, with the PDU session established on the default network slice (e.g. S-NSSAI1);
18. Stop any data transfer, wait for NW releasing the RRC connection due to user inactivity;
19. Initiate data transfer (Ping) on internet DNN, UE sends a SERVICE REQUEST message, check the s-NSSAI-List in RRCSetupComplete message.

Table 9: Main Message Flow for NSSAI Inclusion Mode C

Step	Direction UE - NW	Message	Comments
2	-->	NAS: REGISTRATION REQUEST	Registration type "initial registration"
3	<--	NAS: REGISTRATION ACCEPT	Including Allowed NSSAI (S-NSSAI1, S-NSSAI2, S-NSSAI3, S-NSSAI4, S-NSSAI5 and S-NSSAI6) and Configured NSSAI (S-NSSAI1, S-NSSAI2, S-NSSAI3, S-NSSAI4, S-NSSAI5 and S-NSSAI6); NSSAI inclusion mode=10 (i.e. NSSAI inclusion mode C)
5	-->	RRC: RRCRequest	
	<--	RRC: RRCSetup	
	-->	RRC: RRCSetupComplete NAS: REGISTRATION REQUEST	In RRCSetupComplete message, the s-NSSAI-List including the S-NSSAIs of Requested NSSAI; in REGISTRATION REQUEST message, Registration type is "initial registration"
6	<--	NAS: REGISTRATION ACCEPT	Including Allowed NSSAI (S-NSSAI1, S-NSSAI2, S-NSSAI3, S-NSSAI4, S-NSSAI5 and S-NSSAI6) and Configured NSSAI (S-NSSAI1, S-NSSAI2, S-NSSAI3, S-NSSAI4, S-NSSAI5 and S-NSSAI6); NSSAI inclusion mode=10 (i.e. NSSAI inclusion mode C)
7	<--	NAS: CONFIGURATION UPDATE COMMAND	Including Allowed NSSAI (S-NSSAI1, S-NSSAI2, S-NSSAI3, S-NSSAI4 and S-NSSAI5), Configured NSSAI (S-NSSAI1, S-NSSAI2, S-NSSAI3, S-NSSAI4 and S-NSSAI5) and Rejected NSSAI(S-NSSAI6);

			Configuration update indication--> Registration requested (RED) value=1 and Acknowledgement (ACK) value=1
8		NAS: CONFIGURATION UPDATE COMPLETE	
10	-->	RRC: RRCRequest	
	<--	RRC: RRCSetup	
	-->	RRC: RRCSetupComplete NAS: REGISTRATION REQUEST	In RRCSetupComplete message, the s-NSSAI-List including the S-NSSAIs of Requested NSSAI; in REGISTRATION REQUEST message, Registration type is "mobility registration updating"
11	<--	NAS: REGISTRATION ACCEPT	Including Allowed NSSAI (S-NSSAI1, S-NSSAI2, S-NSSAI3 and S-NSSAI4); NSSAI inclusion mode=10 (i.e. NSSAI inclusion mode C)
13	-->	RRC: RRCRequest	
	<--	RRC: RRCSetup	
	-->	RRC: RRCSetupComplete NAS: REGISTRATION REQUEST	In RRCSetupComplete message, the s-NSSAI-List is not included; in REGISTRATION REQUEST message, Registration type is "mobility registration updating", and 5GS update type is "NG-RAN radio capability update needed"
14	<--	NAS:REGISTRATION ACCEPT	Including Allowed NSSAI (S-NSSAI1, S-NSSAI2 and S-NSSAI3); NSSAI inclusion mode=10 (i.e. NSSAI inclusion mode C)
15	-->	RRC: RRCRequest	
	<--	RRC: RRCSetup	

	-->	RRC: RRCSetupComplete NAS: REGISTRATION REQUEST	In RRCSetupComplete message, the s-NSSAI-List is not included; in REGISTRATION REQUEST message, Registration type is "periodic registration updating"
16	<--	NAS: REGISTRATION ACCEPT	Including Allowed NSSAI (S-NSSAI1, S-NSSAI2); NSSAI inclusion mode=10 (i.e. NSSAI inclusion mode C)
19	-->	RRC: RRCRequest	
	<--	RRC: RRCSetup	
	-->	RRC: RRCSetupComplete NAS: SERVICE REQUEST	In RRCSetupComplete message, the s-NSSAI-List is not included

4.1.7.4 Success Criteria

Step 5: UE includes the NSSAI set to the Requested NSSAI in the Access Stratum Connection Establishment caused by the Initial Registration;

Step 10: UE includes the NSSAI set to the Requested NSSAI in the Access Stratum Connection Establishment caused by the Mobility Registration Update;

Step 13: UE includes no NSSAI in the Access Stratum Connection Establishment caused by the Registration procedure used to update the UE capabilities;

Step 15: UE includes no NSSAI in the Access Stratum Connection Establishment caused by the Periodic Registration Update;

Step 19: UE includes no NSSAI in the Access Stratum Connection Establishment caused by the Service Request.

4.1.8 NSSAI Inclusion Mode D

4.1.8.1 Test Objective

The purpose of this test case is to verify the UE supports NSSAI inclusion mode D indicated by NW.

4.1.8.2 Pre-configuration

NW:

- 5GC Cell A belongs to Home PLMN;
- Subscribed S-NSSAIs are configured for UE, Allowed NSSAI (including S-NSSAI1, S-NSSAI2, S-NSSAI3, S-NSSAI4, S-NSSAI5 and S-NSSAI6) and Configured NSSAI (including S-NSSAI1, S-NSSAI2, S-NSSAI3, S-NSSAI4, S-NSSAI5 and S-NSSAI6) can be generated for UE;
- Set the periodic registration update timer(T3512) to the minimum value.

UE:

- The test UICC with USIM should be inserted;
- The UE is in state Switched OFF.

4.1.8.3 Test Procedure

1. Switch on UE;
2. The UE sends a REGISTRATION REQUEST message to initiate the registration procedure;
3. The NW sends a REGISTRATION ACCEPT message including Allowed NSSAI and Configured NSSAI, and the NSSAI inclusion mode IE is set to "NSSAI inclusion mode D";
4. Switch off UE, then Switch on UE;
5. The UE sends a REGISTRATION REQUEST message to initiate the registration procedure, check the s-NSSAI-List in RRCSetupComplete message;
6. The NW sends a REGISTRATION ACCEPT message;
7. From network side, initiates a generic UE configuration update procedure by sending the CONFIGURATION UPDATE COMMAND to the UE with a request to perform the registration procedure;
8. The UE sends a CONFIGURATION UPDATE COMPLETE message;
9. Wait for NW releasing the existing N1 NAS signalling connection;
10. The UE sends a REGISTRATION REQUEST message for mobility registration update, check the s-NSSAI-List in RRCSetupComplete message;
11. The NW sends a REGISTRATION ACCEPT message;
12. Wait for NW releasing the RRC connection due to user inactivity, UE is in 5GMM-IDLE mode;
13. Use setting menu or engineering mode or other method to change UE radio capability for NG-RAN, e.g. change the 5G mode from SA mode to SA+NSA mode, to trigger UE initiate the registration procedure for mobility registration update by sending a REGISTRATION REQUEST message, check the s-NSSAI-List in RRCSetupComplete message;
14. The NW sends a REGISTRATION ACCEPT message;

15. Wait for the periodic registration update timer(T3512) to expire, UE sends a REGISTRATION REQUEST message for periodic registration update, check the s-NSSAI-List in RRCSetupComplete message;
16. The NW sends a REGISTRATION ACCEPT message;
17. Initiate data transfer (Ping) on internet DNN, with the PDU session established on the default network slice (e.g. S-NSSAI1);
18. Stop any data transfer, wait for NW releasing the RRC connection due to user inactivity;
19. Initiate data transfer (Ping) on internet DNN, UE sends a SERVICE REQUEST message, check the s-NSSAI-List in RRCSetupComplete message.

Table 10: Main Message Flow for NSSAI Inclusion Mode D

Step	Direction UE - NW	Message	Comments
2	-->	NAS: REGISTRATION REQUEST	Registration type "initial registration"
3	<--	NAS: REGISTRATION ACCEPT	Including Allowed NSSAI (S-NSSAI1, S-NSSAI2, S-NSSAI3, S-NSSAI4, S-NSSAI5 and S-NSSAI6) and Configured NSSAI (S-NSSAI1, S-NSSAI2, S-NSSAI3, S-NSSAI4, S-NSSAI5 and S-NSSAI6); NSSAI inclusion mode=11 (i.e. NSSAI inclusion mode D)
5	-->	RRC: RRCRequest	
	<--	RRC: RRCSetup	
	-->	RRC: RRCSetupComplete NAS: REGISTRATION REQUEST	In RRCSetupComplete message, the s-NSSAI-List is not included; in REGISTRATION REQUEST message, Registration type is "initial registration"
6	<--	NAS: REGISTRATION ACCEPT	Including Allowed NSSAI (S-NSSAI1, S-NSSAI2, S-NSSAI3, S-NSSAI4, S-NSSAI5 and S-NSSAI6) and Configured NSSAI (S-NSSAI1, S-

			NSSAI2, S-NSSAI3, S-NSSAI4, S-NSSAI5 and S-NSSAI6); NSSAI inclusion mode=11 (i.e. NSSAI inclusion mode D)
7	<--	NAS: CONFIGURATION UPDATE COMMAND	Including Allowed NSSAI (S-NSSAI1, S-NSSAI2, S-NSSAI3, S-NSSAI4 and S-NSSAI5), Configured NSSAI (S-NSSAI1, S-NSSAI2, S-NSSAI3, S-NSSAI4 and S-NSSAI5) and Rejected NSSAI (S-NSSAI6); Configuration update indication--> Registration requested (RED) value=1 and Acknowledgement (ACK) value=1
8		NAS: CONFIGURATION UPDATE COMPLETE	
10	-->	RRC: RRCRequest	
	<--	RRC: RRCSetup	
	-->	RRC: RRCSetupComplete NAS: REGISTRATION REQUEST	In RRCSetupComplete message, the s-NSSAI-List is not included; in REGISTRATION REQUEST message, Registration type is "mobility registration updating"
11	<--	NAS: REGISTRATION ACCEPT	Including Allowed NSSAI (S-NSSAI1, S-NSSAI2, S-NSSAI3 and S-NSSAI4); NSSAI inclusion mode=11 (i.e. NSSAI inclusion mode D)
13	-->	RRC: RRCRequest	
	<--	RRC: RRCSetup	
	-->	RRC: RRCSetupComplete NAS: REGISTRATION REQUEST	In RRCSetupComplete message, the s-NSSAI-List is not included; in REGISTRATION REQUEST message, Registration type

			is “mobility registration updating”, and 5GS update type is “NG-RAN radio capability update needed”
14	<--	NAS:REGISTRATION ACCEPT	Including Allowed NSSAI (S-NSSAI1, S-NSSAI2 and S-NSSAI3); NSSAI inclusion mode=11 (i.e. NSSAI inclusion mode D)
15	-->	RRC: RRCRequest	
	<--	RRC: RRCSetup	
	-->	RRC: RRCSetupComplete NAS: REGISTRATION REQUEST	In RRCSetupComplete message, the s-NSSAI-List is not included; in REGISTRATION REQUEST message, Registration type is “periodic registration updating”
16	<--	NAS: REGISTRATION ACCEPT	Including Allowed NSSAI (S-NSSAI1, S-NSSAI2); NSSAI inclusion mode=11 (i.e. NSSAI inclusion mode D)
19	-->	RRC: RRCRequest	
	<--	RRC: RRCSetup	
	-->	RRC: RRCSetupComplete NAS: SERVICE REQUEST	In RRCSetupComplete message, the s-NSSAI-List is not included

4.1.8.4 Success Criteria

Step 5: UE includes no NSSAI in the Access Stratum Connection Establishment caused by the Initial Registration;

Step 10: UE includes no NSSAI in the Access Stratum Connection Establishment caused by the Mobility Registration Update;

Step 13: UE includes no NSSAI in the Access Stratum Connection Establishment caused by the Registration procedure used to update the UE capabilities;

Step 15: UE includes no NSSAI in the Access Stratum Connection Establishment caused by the Periodic Registration Update;

Step 19: UE includes no NSSAI in the Access Stratum Connection Establishment caused by the Service Request.

4.2 UE Route Selection Policy

4.2.1 URSP Configuration in Initial Registration

4.2.1.1 Test Objective

The purpose of this test case is to verify the URSP rules can be successfully configured and transmitted by the network to 5G devices during the initial registration procedure.

4.2.1.2 Pre-configuration

NW:

- The hardware platform is powered on and the working status is normal;
- The UEs, AMF, UDM and other network elements all support the network slicing function;
- The UE has subscribed for S-NSSAI1, S-NSSAI111 (default);
- A signalling analysis tool and packet capture environment have been created on the AMF and N3 (or UPF).

Table 11: Reference Parameters in URSP

Information Element	Value/remark
UE policy part	
URSP rule 1	
Precedence value of URSP rule	1
Traffic descriptor	
Traffic descriptor component type identifier	'10001000'B (DNN Type)
Route selection descriptor list	
Route selection descriptor 1	
Precedence value of route selection descriptor	1
Route selection descriptor contents	
Route selection descriptor component type	'00000010'B (S-NSSAI type)
Route selection descriptor component	
SST	'00000010'B
SD	0x000001

URSP rule 2	
Precedence value of URSP rule	255
Traffic descriptor	
Traffic descriptor component type identifier	'00000001'B (Match-all Type)
Route selection descriptor list	
Route selection descriptor 1	
Precedence value of route selection descriptor	1
Route selection descriptor contents	
Route selection descriptor component type	'00000010'B (S-NSSAI type)
Route selection descriptor component	
SST	'00000001'B
SD	0x000001

Note 1: The URSP parameters are for reference only, and the specific values are subject to the actual network configuration.

Note 2: For more detail parameters, please see [3] Annex A.

UE:

- The UE is switched off.

4.2.1.3 Test Procedure

1. Switch on the UE;
2. The UE sends a REGISTRATION REQUEST message to initiate the initial registration procedure;
3. The NW sends a REGISTRATION ACCEPT message including Allowed NSSAI and Configured NSSAI, etc.;
4. The UE sends a 5GMM REGISTRATION COMPLETE message to NW;
5. The PCF sends URSP to AMF, AMF encapsulates URSP to MANAGE UE POLICY COMMAND message. The NW sends a DL NAS transport message to UE including the payload containers and MANAGE UE POLICY COMMAND message which contains the URSP configured by the PCF;
6. Check the service message and parameters information involved in the process.

Table 12: Main Message Flow for URSP Configuration in Initial Registration

Step	Direction UE - NW	Message	Comments
2	-->	REGISTRATION REQUEST	Registration type "initial registration"
3	<--	REGISTRATION ACCEPT	Including Allowed NSSAI (S-NSSAI1 and S-NSSAI111), Configured NSSAI (S-NSSAI1 and S-NSSAI111)
5	<--	DL NAS transport	Including URSP

4.2.1.4 Success Criteria

Step 2: The Registration type contained in the Registration request message should be "Initial Registration". The Registration request message contains SUCI;

Step 3: The Registration Accept message includes 5G-GUTI, Allowed NSSAI, and Configured NSSAI (optional) information allocated by AMF;

Step 5: The DL NAS TRANSPORT received by the UE contains the payload containers and MANAGE UE POLICY COMMAND message, which includes the URSP configured by the PCF. UE can successfully store the URSP received from the network.

4.2.2 Update and Delete of URSP

4.2.2.1 Test Objective

The purpose of this test case is to verify the network can update or delete URSP information and the updated URSP can be sent to UE for the subsequent application service.

4.2.2.2 Pre-configuration

NW:

- The hardware platform is powered on and the working status is normal;
- The UEs, AMF, UDM and other network elements all support the network slicing function;
- The UE has subscribed for S-NSSAI1, S-NSSAI2, S-NSSAI111 (default);

- A signalling analysis tool and packet capture environment have been created on the AMF and N3 (or UPF).

UE:

- The UE is switched on;
- The test application is installed in the UE. APP1 can match URSP rule-1 with DNN1.

For the reference parameters of URSP rules, please see Table 11.

4.2.2.3 Test Procedure

1. Step 2-4 in 4.2.1.3 are performed;
2. The NW sends a DL NAS transport message to UE including the payload containers and MANAGE UE POLICY COMMAND message which contains the URSP configured by the PCF. A PDU Session to the default DNN using the default S-NSSAI is established;
3. Start APP1 on the UE, or start an App simulator by appropriate tool. The UE matches the locally stored URSP according to the DNN1 provided by the APP1. The UE initiates a PDU session establishment request with the S-NSSAI1, SSC mode and PDU session type obtained from the Route Selection Descriptor in URSP;
4. The NW sends PDU session establishment accept message to UE;
5. Stop APP1;
6. PCF updates the URSP, i.e. PCF changes the S-NSSAI corresponding to DNN1 from S-NSSAI1 to S-NSSAI2, and changes UPSC#2 to UPSC#22;
7. Repeat step 2-5;
8. PCF deletes the URSP;
9. The NW sends a DL NAS transport message to UE including the payload containers, which includes the empty URSP;
10. Start APP1 on the UE, or start an App simulator by appropriate tool. Checking whether the service is running on the default PDU session in default network slice.

Table 13: Main Message Flow for Update and Delete of URSP

Step	Direction UE - NW	Message	Comments
1	-->	REGISTRATION REQUEST	Registration type "initial registration"

	<--	REGISTRATION ACCEPT	Including Allowed NSSAI (S-NSSAI1 and S-NSSAI111), Configured NSSAI (S-NSSAI1 and S-NSSAI111)
2	<--	DL NAS transport	Including URSP rule-1: traffic descriptor (DNN1), route selection descriptor (S-NSSAI1); URSP rule-3: traffic descriptor (match-all), route selection descriptor (S-NSSAI111)
	-->	PDU session establishment request	Including S-NSSAI111
	<--	PDU session establishment accept	
3	-->	PDU session establishment request	Including DNN1 and S-NSSAI1
4	<--	PDU session establishment accept	
7	<--	DL NAS transport	Including URSP rule-1: traffic descriptor (DNN1), route selection descriptor (S-NSSAI2) ; URSP rule-3: traffic descriptor (match-all), route selection descriptor (S-NSSAI111)
	-->	PDU session establishment request	Including DNN1 and S-NSSAI2
	<--	PDU session establishment accept	
9	<--	DL NAS transport	Including an empty URSP

4.2.2.4 Success Criteria

Step 2: The DL NAS TRANSPORT received by the UE contains the payload containers and MANAGE UE POLICY COMMAND message, which includes the URSP configured by the PCF. UE can successfully store the URSP received from the network;

Step 3: Checking the User Plane data to see if the service is running in the correct PDU session, i.e. the DNN1 provided by the APP1 is the same as the traffic descriptor DNN1 in URSP. By matching the URSP with DNN1, UE can obtain the associated S-NSSAI1 in URSP. And UE initiates the establishment of a new PDU session with the S-NSSAI1 obtained from the URSP. The SSC mode, S-NSSAI or PDU session type of the new established PDU session is the same as these parameters in Route Selection Descriptor in URSP. And checking the service can run in the correct PDU session in network slice 1 (S-NSSAI1) rather than the default network slice;

Step 7: Checking the same criteria for step 3, but the APP1 service can run in the correct PDU session in network slice 2 (S-NSSAI2) rather than the default network slice or network slice 1 (S-NSSAI1). The UPSC#2 updates to UPSC#22;

Step 10: Checking the APP1 is running in the default PDU session in default network slice.

4.2.3 Traffic Descriptors in URSP --- APPID

4.2.3.1 Test Objective

The purpose of this test case is to verify 5G devices can map the traffic descriptors – APPID to the S-NSSAI according to the URSP provided by the network, and can establish PDU session with S-NSSAI, which associate with the APPID, to perform data transmission.

4.2.3.2 Pre-configuration

NW:

- The hardware platform is powered on and the working status is normal;
- The UEs, AMF, UDM and other network elements all support the network slicing function;
- The UE has subscribed S-NSSAI1, S-NSSAI111 (default);
- APP1 in UE has subscribed for network slice S-NSSAI1, and APP2 in UE has not subscribed for any network slice;
- A signalling analysis tool and packet capture environment have been created on the AMF and N3 (or UPF).

UE:

- The UE is switched on;
- The test application is installed in the UE. According to the network configuration, APP1 can match with URSP rule-1 with APP ID-1, and APP2 cannot match with any URSP rules except the default URSP rule (match-all traffic descriptor) with APP ID-2.

For the reference parameters of URSP rules, please see Table 11.

4.2.3.3 Test Procedure

1. Step 2-4 in 4.2.1.3 are performed;
2. The NW sends a DL NAS transport message to UE including the payload containers and MANAGE UE POLICY COMMAND message which contains the URSP configured by the PCF. A PDU Session to the default DNN using the default S-NSSAI is established;
3. Start APP2 on the UE, or start an App simulator by appropriate tool. The UE cannot match the locally stored URSP according to the APP ID-2 provided by the APP2. The UE routes the traffic to the default PDU Session;
4. Start APP1 on the UE, or start an App simulator by appropriate tool. The UE matches the locally stored URSP according to the APP ID-1 provided by the APP1. The UE initiates a PDU session establishment request with the S-NSSAI, SSC mode and PDU session type obtained from the Route Selection Descriptor in URSP;
5. The NW sends PDU session establishment accept message to UE.

Table 14: Main Message Flow for Traffic Descriptors in URSP -- APPID

Step	Direction UE - NW	Message	Comments
1	-->	REGISTRATION REQUEST	
	<--	REGISTRATION ACCEPT	Including Allowed NSSAI (S-NSSAI1 and S-NSSAI111), Configured NSSAI (S-NSSAI1 and S-NSSAI111)
2	<--	DL NAS transport	Including URSP rule-1: traffic descriptor (APP ID-1), route selection descriptor (S-NSSAI1); URSP rule-3:

			traffic descriptor (match-all), route selection descriptor (S-NSSAI111)
	-->	PDU session establishment request	Including S-NSSAI111
	<--	PDU session establishment accept	
4	-->	PDU session establishment request	Including S-NSSAI1
5	<--	PDU session establishment accept	

4.2.3.4 Success Criteria

UE selects specified PDU session for service by matching the URSP rule:

Step 2: The DL NAS TRANSPORT received by the UE contains the payload containers and MANAGE UE POLICY COMMAND message, which includes the URSP configured by the PCF. UE can successfully store the URSP received from the network;

Step 3: Checking the User Plane data to see if the traffic of APP2 is transmitted in the correct PDU session, i.e. the default PDU session in default network slice;

Step 4: The UE initiates a new PDU Session according to the Route Selection Descriptor in URSP rule-1. The traffic of APP1 is transmitted on the new PDU Session. This application service can be used normally on the new established PDU session. The traffic of APP1 is transmitted in the new established PDU session.

4.2.4 Traffic Descriptors in URSP --- DNN

4.2.4.1 Test Objective

The purpose of this test case is to verify 5G devices can map the traffic descriptors – DNN to the S-NSSAI according to the URSP provided by the network, and can establish PDU session with S-NSSAI, which associate with the DNN, to perform data transmission.

4.2.4.2 Pre-configuration

NW:

- The hardware platform is powered on and the working status is normal;
- The UEs, AMF, UDM and other network elements all support the network slicing function;
- The UE has subscribed for S-NSSAI1, S-NSSAI111 (default);
- APP1 in UE has subscribed for network slice S-NSSAI1, and APP2 in UE has not subscribed for network slice;
- A signalling analysis tool and packet capture environment have been created on the AMF and N3 (or UPF).

UE:

- The UE is switched on;
- The device supports associating the DNN with the S-NSSAI according to the URSP rule, and creates a PDU session for the corresponding APP on the associated slice. APP1 is associated with DNN1, APP2 is associated with DNN2, and both DNN1 and DNN2 are of INTERNET type. (DNN cannot be CMWAP or IMS type);
- The test application is installed in the UE. According to the network configuration, APP1 can match URSP rule-1 with DNN1. APP2 cannot match any URSP rules except the default URSP rule (with match-all traffic descriptor) with DNN2.

For the reference parameters of URSP rules, please see Table 11.

4.2.4.3 Test Procedure

1. Step 2-4 in 4.2.1.3 are performed;
2. The NW sends a DL NAS transport message to UE including the payload containers and MANAGE UE POLICY COMMAND message which contains the URSP configured by the PCF. A PDU Session to the default DNN using the default S-NSSAI is established;
3. Start APP2 on the UE, or start an App simulator by appropriate tool. The UE cannot match the locally stored URSP according to the DNN2 provided by the APP2;
4. Start APP1 on the UE, or start an App simulator by appropriate tool. The UE matches the locally stored URSP according to the DNN1 provided by the APP1. The UE initiates a PDU session establishment request with the S-NSSAI, SSC mode and PDU session type obtained from the Route Selection Descriptor in URSP;
5. The NW sends PDU session establishment accept message to UE.

Table 15: Main Message Flow for Traffic Descriptors in URSP -- DNN

Step	Direction UE - NW	Message	Comments
1	-->	REGISTRATION REQUEST	
	<--	REGISTRATION ACCEPT	Including Allowed NSSAI (S-NSSAI1 and S-NSSAI111), Configured NSSAI (S-NSSAI1 and S-NSSAI111)
2	<--	DL NAS transport	Including URSP rule-1: traffic descriptor (DNN1), route selection descriptor (S-NSSAI1); URSP rule-3: traffic descriptor (match-all), route selection descriptor (S-NSSAI111)
	-->	PDU session establishment request	Including S-NSSAI111
	<--	PDU session establishment accept	
4	-->	PDU session establishment request	Including S-NSSAI1
5	<--	PDU session establishment accept	

4.2.4.4 Success Criteria

UE selects specified PDU session for service by matching the URSP rule:

Step 2: The DL NAS TRANSPORT received by the UE contains the payload containers and MANAGE UE POLICY COMMAND message, which includes the URSP configured by the PCF. UE can successfully store the URSP received from the network;

Step 3: Checking the User Plane data to see if the traffic of APP2 is transmitted in the correct PDU session, i.e. in the default PDU session in default network slice;

Step 4: The UE initiates a new PDU Session according to the Route Selection Descriptor in URSP rule-1. The traffic of APP1 is transmitted on the new PDU Session. This application service can be used normally on the new established PDU session. APP1 is transmitted in the new established PDU session.

4.2.5 Traffic Descriptors in URSP --- IP

4.2.5.1 Test Objective

The purpose of this test case is to verify 5G devices can map the traffic descriptors – IP to the S-NSSAI according to the URSP provided by the network, and can establish PDU session with S-NSSAI, which associate with the IP, to perform data transmission.

4.2.5.2 Pre-configuration

NW:

- The hardware platform is powered on and the working status is normal;
- The UEs, AMF, UDM and other network elements all support the network slicing function;
- The UE has subscribed for S-NSSAI1, S-NSSAI111 (default);
- APP1 in UE has subscribed for network slice S-NSSAI1, and APP2 in UE has not subscribed for network slice;
- A signalling analysis tool and packet capture environment have been created on the AMF and N3 (or UPF).

UE:

- The UE is switched on;
- The test application is installed in the UE. According to the network configuration, APP1 can match URSP rule-1 with IP1. APP2 cannot match any URSP rules except the default URSP rule (with match-all traffic descriptor) with IP2.

For the reference parameters of URSP rules, please see Table 11.

4.2.5.3 Test Procedure

1. Step 2-4 in 4.2.1.3 are performed;
2. The NW sends a DL NAS transport message to UE including the payload containers and MANAGE UE POLICY COMMAND message which contains the URSP configured by the PCF. A PDU Session to the default DNN using the default S-NSSAI is established;

3. Start APP2 on the UE, or start an App simulator by appropriate tool. The UE cannot match the locally stored URSP according to the IP2 provided by the APP2;
4. Start APP1 on the UE, or start an App simulator by appropriate tool. The UE matches the locally stored URSP according to the IP1 provided by the APP1. The UE initiates a PDU session establishment request with the S-NSSAI, SSC mode and PDU session type obtained from the Route Selection Descriptor in URSP;
5. The NW sends PDU session establishment accept message to UE.

Table 16: Main Message Flow for Traffic Descriptors in URSP -- IP

Step	Direction UE - NW	Message	Comments
1	-->	REGISTRATION REQUEST	
	<--	REGISTRATION ACCEPT	Including Allowed NSSAI (S-NSSAI1 and S-NSSAI111), Configured NSSAI (S-NSSAI1 and S-NSSAI111)
2	<--	DL NAS transport	Including URSP rule-1: traffic descriptor (IP1), route selection descriptor (S-NSSAI1); URSP rule-3: traffic descriptor (match-all), route selection descriptor (S-NSSAI111)
	-->	PDU session establishment request	Including S-NSSAI111
	<--	PDU session establishment accept	
4	-->	PDU session establishment request	Including S-NSSAI1
5	<--	PDU session establishment accept	

4.2.5.4 Success Criteria

UE selects specified PDU session for service by matching the URSP rule:

Step 2: The DL NAS TRANSPORT received by the UE contains the payload containers and MANAGE UE POLICY COMMAND message, which includes the URSP configured by the PCF. UE can successfully store the URSP received from the network;

Step 3: Checking the User Plane data to see if the traffic of APP2 is transmitted in the correct PDU session, i.e. in the default PDU session in default network slice;

Step 4: The UE initiates a new PDU Session according to the Route Selection Descriptor in URSP rule-1. The traffic of APP1 is transmitted on the new PDU Session. This application service can be used normally on the new established PDU session. APP1 is transmitted in the new established PDU session.

4.2.6 Traffic Descriptors in URSP --- IP 3 Tuple

4.2.6.1 Test Objective

The purpose of this test case is to verify 5G devices can map the traffic descriptors – IP 3 tuple to the S-NSSAI according to the URSP provided by the network, and can establish PDU session with S-NSSAI, which associate with the IP 3 tuple, to perform data transmission.

4.2.6.2 Pre-configuration

NW:

- The hardware platform is powered on and the working status is normal;
- The UEs, AMF, UDM and other network elements all support the network slicing function;
- The UE has subscribed for S-NSSAI1, S-NSSAI111 (default);
- APP1 in UE has subscribed for network slice S-NSSAI1, and APP2 in UE has not subscribed for network slice;
- A signalling analysis tool and packet capture environment have been created on the AMF and N3 (or UPF).

UE:

- The UE is switched on;
- The test application is installed in the UE. According to the network configuration, APP1 can match URSP rule-1 with IP 3 tuple-1. APP2 cannot match any URSP rules except the default URSP rule (with match-all traffic descriptor) with IP 3 tuple-2.

For the reference parameters of URSP rules, please see Table 11.

4.2.6.3 Test Procedure

1. Step 2-4 in 4.2.1.3 are performed;
2. The NW sends a DL NAS transport message to UE including the payload containers and MANAGE UE POLICY COMMAND message which contains the URSP configured by the PCF. A PDU Session to the default DNN using the default S-NSSAI is established;
3. Start APP2 on the UE, or start an App simulator by appropriate tool. The UE cannot match the locally stored URSP according to the IP 3 tuple-2 provided by the APP2;
4. Start APP1 on the UE, or start an App simulator by appropriate tool. The UE matches the locally stored URSP according to the IP 3 tuple-1 provided by the APP1. The UE initiates a PDU session establishment request with the S-NSSAI, SSC mode and PDU session type obtained from the Route Selection Descriptor in URSP;
5. The NW sends PDU session establishment accept message to UE.

Table 17: Main Message Flow for Traffic Descriptors in URSP -- IP 3 Tuple

Step	Direction UE - NW	Message	Comments
1	-->	REGISTRATION REQUEST	
	<--	REGISTRATION ACCEPT	Including Allowed NSSAI (S-NSSAI1 and S-NSSAI111), Configured NSSAI (S-NSSAI1 and S-NSSAI111)
2	<--	DL NAS transport	Including URSP rule-1: traffic descriptor (IP 3 tuple-1), route selection descriptor (S-NSSAI1); URSP rule-3: traffic descriptor (match-all), route selection descriptor (S-NSSAI111)
	-->	PDU session establishment request	Including S-NSSAI111

	<--	PDU session establishment accept	
4	-->	PDU session establishment request	Including S-NSSAI1
5	<--	PDU session establishment accept	

4.2.6.4 Success Criteria

UE selects specified PDU session for service by matching the URSP rule:

Step 2: The DL NAS TRANSPORT received by the UE contains the payload containers and MANAGE UE POLICY COMMAND message, which includes the URSP configured by the PCF. UE can successfully store the URSP received from the network;

Step 3: Checking the User Plane data to see if the traffic of APP2 is transmitted in the correct PDU session, i.e. in the default PDU session in default network slice;

Step 4: The UE initiates a new PDU Session according to the Route Selection Descriptor in URSP rule-1. The traffic of APP1 is transmitted on the new PDU Session. This application service can be used normally on the new established PDU session. APP1 is transmitted in the new established PDU session.

4.2.7 Traffic Descriptors in URSP --- FQDN

4.2.7.1 Test Objective

The purpose of this test case is to verify 5G devices can map the traffic descriptors – FQDN to the S-NSSAI according to the URSP provided by the network, and can establish PDU session with S-NSSAI, which associate with the destination FQDN, to perform data transmission.

4.2.7.2 Pre-configuration

NW:

- The hardware platform is powered on and the working status is normal;
- The UEs, AMF, UDM and other network elements all support the network slicing function;
- The UE has subscribed for S-NSSAI1, S-NSSAI111 (default);

- APP1 in UE has subscribed for network slice S-NSSAI1, and APP2 in UE has not subscribed for network slice;
- A signalling analysis tool and packet capture environment have been created on the AMF and N3 (or UPF).

UE:

- The UE is switched on;
- The test application is installed in the UE. According to the network configuration, APP1 can match URSP rule-1 with FQDN1. APP2 cannot match any URSP rules except the default URSP rule (with match-all traffic descriptor) with FQDN2.

For the reference parameters of URSP rules, please see Table 11.

4.2.7.3 Test procedure

1. Step 2-4 in 4.2.1.3 are performed;
2. The NW sends a DL NAS transport message to UE including the payload containers and MANAGE UE POLICY COMMAND message which contains the URSP configured by the PCF. A PDU Session to the default DNN using the default S-NSSAI is established;
3. Start APP2 on the UE, or start an App simulator by appropriate tool. The UE cannot match the locally stored URSP according to the FQDN2 provided by the APP2;
4. Start APP1 on the UE, or start an App simulator by appropriate tool. The UE matches the locally stored URSP according to the FQDN1 provided by the APP1. The UE initiates a PDU session establishment request with the S-NSSAI, SSC mode and PDU session type obtained from the Route Selection Descriptor in URSP;
5. The NW sends PDU session establishment accept message to UE.

Table 18: Main Message Flow for Traffic Descriptors in URSP -- FQDN

Step	Direction UE - NW	Message	Comments
1	-->	REGISTRATION REQUEST	
	<--	REGISTRATION ACCEPT	Including Allowed NSSAI (S-NSSAI1 and S-NSSAI111), Configured NSSAI (S-NSSAI1 and S-NSSAI111)

2	<--	DL NAS transport	Including URSP rule-1: traffic descriptor (FQDN1), route selection descriptor (S-NSSAI1); URSP rule-3: traffic descriptor (match-all), route selection descriptor (S-NSSAI111)
	-->	PDU session establishment request	Including S-NSSAI111
	<--	PDU session establishment accept	
4	-->	PDU session establishment request	Including S-NSSAI1
5	<--	PDU session establishment accept	

4.2.7.4 Success Criteria

UE selects specified PDU session for service by matching the URSP rule:

Step 2: The DL NAS TRANSPORT received by the UE contains the payload containers and MANAGE UE POLICY COMMAND message, which includes the URSP rule-1 configured by the PCF. UE can successfully store the URSP received from the network;

Step 3: Checking the User Plane data to see if the traffic of APP2 is transmitted in the correct PDU session, i.e. in the default PDU session in default network slice;

Step 4: the UE initiates a new PDU Session according to the Route Selection Descriptor in URSP rule-1. The traffic of APP1 is transmitted on the new PDU Session. This application service can be used normally on the new established PDU session. APP1 is transmitted in the new established PDU session.

4.2.8 Traffic Descriptors in URSP --- OSID+OSAPPID

4.2.8.1 Test Objective

The purpose of this test case is to verify 5G devices can map the traffic descriptors – OSID+OSAPPID to the S-NSSAI according to the URSP provided by the network, and can

establish PDU session with S-NSSAI, which associate with the OSID+OSAPPID, to perform data transmission.

4.2.8.2 Pre-configuration

NW:

- The hardware platform is powered on and the working status is normal;
- The UEs, AMF, UDM and other network elements all support the network slicing function;
- The UE has subscribed for S-NSSAI1, S-NSSAI111 (default);
- APP1 in UE has subscribed for network slice S-NSSAI1, and APP2 in UE has not subscribed for network slice;
- A signalling analysis tool and packet capture environment have been created on the AMF and N3 (or UPF).

UE:

- The UE is switched on;
- The test application is installed in the UE. According to the network configuration, APP1 can match URSP rule-1 with OSID+OSAPPID-1. APP2 cannot match any URSP rules except the default URSP rule (with match-all traffic descriptor) with OSID+OSAPPID-2.

For the reference parameters of URSP rules, please see Table 11.

4.2.8.3 Test Procedure

1. Step 2-4 in 4.2.1.3 are performed;
2. The NW sends a DL NAS transport message to UE including the payload containers and MANAGE UE POLICY COMMAND message which contains the URSP configured by the PCF. A PDU Session to the default DNN using the default S-NSSAI is established;
3. Start APP2 on the UE, or start an App simulator by appropriate tool. The UE cannot match the locally stored URSP according to the OSID+OSAPPID-2 provided by the APP2;
4. Start APP1 on the UE, or start an App simulator by appropriate tool. The UE matches the locally stored URSP according to the OSID+OSAPPID-1 provided by the APP1. The UE initiates a PDU session establishment request with the S-NSSAI, SSC mode and PDU session type obtained from the Route Selection Descriptor in URSP;
5. The NW sends PDU session establishment accept message to UE.

Table 19: Main Message Flow for Traffic Descriptors in URSP -- OSID+OSAPPID

Step	Direction UE - NW	Message	Comments
1	-->	REGISTRATION REQUEST	
	<--	REGISTRATION ACCEPT	Including Allowed NSSAI (S-NSSAI1 and S-NSSAI111), Configured NSSAI (S-NSSAI1 and S-NSSAI111)
2	<--	DL NAS transport	Including URSP rule-1: traffic descriptor (OSID+OSAPPID-1), route selection descriptor (S-NSSAI1); URSP rule-3: traffic descriptor (match-all), route selection descriptor (S-NSSAI111)
	-->	PDU session establishment request	Including S-NSSAI111
	<--	PDU session establishment accept	
4	-->	PDU session establishment request	Including S-NSSAI1
5	<--	PDU session establishment accept	

4.2.8.4 Success Criteria

UE selects specified PDU session for service by matching the URSP rule:

Step 2: The DL NAS TRANSPORT received by the UE contains the payload containers and MANAGE UE POLICY COMMAND message, which includes the URSP rule-1 configured by the PCF. UE can successfully store the URSP received from the network;

Step 3: Checking the User Plane data to see if the traffic of APP2 is transmitted in the correct PDU session, i.e. in the default PDU session in default network slice;

Step 4: The UE initiates a new PDU Session according to the Route Selection Descriptor in URSP rule-1. The traffic of APP1 is transmitted on the new PDU Session. This application service can be used normally on the new established PDU session. APP1 is transmitted in the new established PDU session.

4.2.9 Traffic Descriptors in URSP --- Match-all

4.2.9.1 Test Objective

The purpose of this test case is to verify 5G devices can map the traffic descriptors – Match-all to the S-NSSAI according to the URSP provided by the network, and can establish PDU session with S-NSSAI, which associate with Match-all, to perform data transmission.

4.2.9.2 Pre-configuration

NW:

- The hardware platform is powered on and the working status is normal;
- The UEs, AMF, UDM and other network elements all support the network slicing function;
- The UE has subscribed for S-NSSAI1, S-NSSAI111 (default);
- APP1 in UE has subscribed for network slice S-NSSAI1, and APP2 in UE has not subscribed for network slice;
- A signalling analysis tool and packet capture environment have been created on the AMF and N3 (or UPF).

UE:

- The UE is switched on;
- The test application is installed in the UE. According to the network configuration, APP1 can match URSP rule-1 with match-all and S-NSSAI-111 in route selection descriptor.

For the reference parameters of URSP rules, please see Table 11.

4.2.9.3 Test Procedure

1. Step 2-4 in 4.2.1.3 are performed;
2. The NW sends a DL NAS transport message to UE including the payload containers and MANAGE UE POLICY COMMAND message which contains the URSP configured by the PCF. A PDU Session to the default DNN using the default S-NSSAI is established;

3. Start APP1 on the UE, or start an App simulator by appropriate tool. The UE matches the locally stored URSP according to the match-all traffic descriptor provided by the APP1.

Table 20: Main Message Flow for Traffic Descriptors in URSP -- Match-all

Step	Direction UE - NW	Message	Comments
1	-->	REGISTRATION REQUEST	
	<--	REGISTRATION ACCEPT	Including Allowed NSSAI (S-NSSAI1 and S-NSSAI111), Configured NSSAI (S-NSSAI1 and S-NSSAI111)
2	<--	DL NAS transport	Including URSP rule-1: traffic descriptor (match-all), route selection descriptor (S-NSSAI111)
	-->	PDU session establishment request	Including S-NSSAI111
	<--	PDU session establishment accept	

4.2.9.4 Success Criteria

UE selects specified PDU session for service by matching the URSP rule:

Step 2: The DL NAS TRANSPORT received by the UE contains the payload containers and MANAGE UE POLICY COMMAND message, which includes the URSP rule-1 configured by the PCF. UE can successfully store the URSP received from the network;

Step 3: Checking the User Plane data to see if the traffic of APP1 is transmitted in the correct PDU session, i.e. the default PDU session in S-NSSAI-111.

4.2.10 Multi-dimensional Matching in URSP

4.2.10.1 Multiple URSP rules --- URSP Rules Precedence

4.2.10.1.1 Test Objective

The purpose of this test case is to verify the support of URSP rules priority.

4.2.10.1.2 Pre-configuration

NW:

- The hardware platform is powered on and the working status is normal;
- The UEs, AMF, UDM and other network elements all support the network slicing function;
- The UE has subscribed for S-NSSAI1, S-NSSAI2, S-NSSAI111 (default). The PCF is configured with UE policies. At least two or more URSP rules with different precedence should be configured at the same time. URSP rule-1 is associated with APPID-11 with high URSP rule precedence and S-NSSAI1, and URSP rule-2 with low URSP rule precedence is associated with APPID-1 and S-NSSAI2;
- APP1 in UE has subscribed for network slice S-NSSAI2;
- A signalling analysis tool and packet capture environment have been created on the AMF and N3 (or UPF).

UE:

- The UE is switched on;
- The test application is installed in the UE. According to the network configuration, APP1 can match URSP rule-2 with APPID-1.

4.2.10.1.3 Test Procedure

1. Step 2-4 in 4.2.1.3 are performed;
2. The NW sends a DL NAS transport message to UE including the payload containers and MANAGE UE POLICY COMMAND message, which includes the URSP configured by the PCF. A PDU Session to the default DNN using the default S-NSSAI is established;
3. Start APP1 on the UE, or start an App simulator by appropriate tool. The UE matches the locally stored URSP rule-2 according to the APPID-1 provided by the APP1. The UE initiates a PDU session establishment request with the S-NSSAI2, SSC mode and PDU session type obtained from the Route Selection Descriptor in URSP rule-2;
4. The NW sends PDU session establishment accept message to UE.

Table 21: Main Message Flow for Multiple URSP Rules -- URSP Rules Precedence

Step	Direction UE - NW	Message	Comments
1	-->	REGISTRATION REQUEST	
	<--	REGISTRATION ACCEPT	Including Allowed NSSAI (S-NSSAI1, S-NSSAI2 and S-NSSAI111), Configured NSSAI (S-NSSAI1, S-NSSAI2 and S-NSSAI111)
2	<--	DL NAS transport	Including URSP rule-1: URSP rule precedence (1), traffic descriptor (APPID-11), route selection descriptor (S-NSSAI1); URSP rule-2: URSP rule precedence (2), traffic descriptor (APPID-1), route selection descriptor (S-NSSAI2); URSP rule-3: URSP rule precedence (9), traffic descriptor (match-all), route selection descriptor (S-NSSAI111)
	-->	PDU session establishment request	Including S-NSSAI111
	<--	PDU session establishment accept	
3	-->	PDU session establishment request	Including S-NSSAI2
4	<--	PDU session establishment accept	

4.2.10.1.4 Success Criteria

UE selects specified PDU session for service by matching the URSP rule:

Step 2: The DL NAS TRANSPORT received by the UE contains the payload containers and MANAGE UE POLICY COMMAND message, which includes the URSP configured by the PCF. UE can successfully store the URSP received from the network.

Step 3: The APP ID provided by the APP1 can match the appropriate URSP rule according to the URSP rule precedence. The APPID-1 provided by the APP1 is the same as the traffic descriptor APPID in the URSP rule-2 with low precedence. By matching the URSP rule-2 with APPID-1, UE and can obtain the associated S-NSSAI2 in URSP rule-2. And UE initiates the establishment of a new PDU session with the S-NSSAI2 obtained from the URSP rule-2. The SSC mode, S-NSSAI2 or PDU session type of the new established PDU session is the same as these parameters in Route Selection Descriptor in URSP rule-2. This application service can be used normally on the new established PDU session. And checking the service can run in the correct PDU session in network slice S-NSSAI2 rather than the default network slice.

4.2.10.2 Single URSP rules --- Route Selection Descriptor Precedence

4.2.10.2.1 Test Objective

The purpose of this test case is to verify the support of route selection descriptor priority in URSP rule.

4.2.10.2.2 Pre-configuration

NW:

- The hardware platform is powered on and the working status is normal;
- The UEs, AMF, UDM and other network elements all support the network slicing function;
- The UE has subscribed for S-NSSAI1, S-NSSAI2, S-NSSAI111 (default). The PCF is configured with UE policies. URSP rule-1 is associate with APPID-1 with only one route selection descriptor-2 (low route selection descriptor precedence) and is configured with S-NSSAI2. URSP rule-2 is associated with APPID-1 with two or more route selection descriptors. Route selection descriptor-1 with high route selection descriptor precedence is configured with S-NSSAI1, route selection descriptor-2 with low route selection descriptor precedence is configured with S-NSSAI2;

- A signalling analysis tool and packet capture environment have been created on the AMF and N3 (or UPF).

UE:

- The UE is switched on;
- The test application is installed in the UE. APP1 can match URSP rule with APPID-1.

4.2.10.2.3 Test Procedure

1. Step 2-4 in 4.2.1.3 are performed;
2. The NW sends a DL NAS transport message to UE including the payload containers and MANAGE UE POLICY COMMAND message, which includes the URSP rule-1 configured by the PCF. A PDU Session to the default DNN using the default S-NSSAI is established;
3. Start APP1 on the UE, or start an App simulator by appropriate tool. The UE matches the locally stored URSP rule-1 according to the APPID-1 provided by the APP1. The UE initiates a PDU session establishment request with the S-NSSAI2, SSC mode and PDU session type obtained from the Route Selection Descriptor in URSP;
4. The NW sends PDU session establishment accept message to UE;
5. Stop using APP1. The NW sends a DL NAS transport message to UE including the payload containers and MANAGE UE POLICY COMMAND message, which includes the URSP rule-2 configured by the PCF;
6. Start APP1 on the UE, or start an App simulator by appropriate tool. The UE matches the locally stored URSP rule-2 according to the APPID-1 provided by the APP1. The UE initiates a PDU session establishment request with the S-NSSAI1, SSC mode and PDU session type obtained from the Route Selection Descriptor in URSP;
7. The NW sends PDU session establishment accept message to UE.

Table 22: Main Message Flow for Single URSP Rules -- Route Selection Descriptor Precedence

Step	Direction UE - NW	Message	Comments
1	-->	REGISTRATION REQUEST	
	<--	REGISTRATION ACCEPT	Including Allowed NSSAI (S-NSSAI1, S-NSSAI2 and S-NSSAI111), Configured

			NSSAI (S-NSSAI1, S-NSSAI2 and S-NSSAI111)
2	<--	DL NAS transport	Including URSP rule-1: traffic descriptor (APPID-1), route selection descriptor-2 (S-NSSAI2); URSP rule-3: traffic descriptor (match-all), route selection descriptor (S-NSSAI111)
	-->	PDU session establishment request	Including S-NSSAI111
	<--	PDU session establishment accept	
3	-->	PDU session establishment request	Including S-NSSAI2
4	<--	PDU session establishment accept	
5	<--	DL NAS transport	Including URSP rule-2: traffic descriptor (APPID-1), route selection descriptor-1 (S-NSSAI1, route selection descriptor precedence: 1), route selection descriptor-2 (S-NSSAI2, route selection descriptor precedence: 2); URSP rule-3: traffic descriptor (match-all), route selection descriptor (S-NSSAI111).
6	-->	PDU session establishment request	Including S-NSSAI1
7	<--	PDU session establishment accept	

4.2.10.2.4 Success Criteria

UE selects specified PDU session for service by matching the URSP rule:

Step 2: The DL NAS TRANSPORT received by the UE contains the payload containers and MANAGE UE POLICY COMMAND message, which includes the URSP rule-1 configured by the PCF. UE can successfully store the URSP rule-1 received from the network;

Step 3: the APP ID-1 provided by the APP1 can match the URSP rule-1. The APPID-1 provided by the APP1 is the same as the traffic descriptor APPID in the URSP rule-1. By matching the URSP rule-1 with APPID-1, UE and can obtain the associated S-NSSAI in route selection descriptor-2 in URSP rule-1. And UE initiates the establishment of a new PDU session with the S-NSSAI2 obtained from the URSP rule-1. The SSC mode, S-NSSAI2 or PDU session type of the new established PDU session is the same as these parameters in Route Selection Descriptor-2 in URSP rule-1. This application service can be used normally on the new established PDU session. And checking the service can run in the correct PDU session in network slice S-NSSAI2 rather than the default network slice;

Step 5: The DL NAS TRANSPORT received by the UE contains the payload containers and MANAGE UE POLICY COMMAND message, which includes the URSP rule-2 configured by the PCF. UE can successfully store the URSP rule-2 received from the network;

Step 6: The APP ID-1 provided by the APP1 can match the URSP rule-2. The APPID-1 provided by the APP1 is the same as the traffic descriptor APPID in the URSP rule-2. By matching the URSP rule-2 with APPID-1, UE and can obtain the associated S-NSSAI1 in route selection descriptor-1 in URSP rule-2. And UE initiates the establishment of a new PDU session with the S-NSSAI1 obtained from the URSP rule-2. The SSC mode, S-NSSAI1 or PDU session type of the new established PDU session is the same as these parameters in Route Selection Descriptor-1 in URSP rule-2. This application service can be used normally on the new established PDU session. And checking the service can run in the correct PDU session in network slice S-NSSAI1 rather than the default network slice.

4.2.10.3 Single URSP rules --- Multiple Traffic Descriptors

4.2.10.3.1 Test Objective

The purpose of this test case is to verify that single service can match multiple traffic descriptors scenario.

4.2.10.3.2 Pre-configuration

NW:

- The hardware platform is powered on and the working status is normal;
- The UEs, AMF, UDM and other network elements all support the network slicing function;
- The UE has subscribed for S-NSSAI1, S-NSSAI111 (default). The PCF is configured with UE policies. URSP rule-1 is associate with APPID-1 and DNN1 with one route selection descriptor-1;
- APP1 in UE has subscribed for network slice S-NSSAI1;
- A signalling analysis tool and packet capture environment have been created on the AMF and N3 (or UPF).

UE:

- The UE is switched on;
- The test application is installed in the UE. APP1 can match URSP rule-1 with APPID-1 and DNN1.

4.2.10.3.3 Test Procedure

1. Step 2-4 in 4.2.1.3 are performed;
2. The NW sends a DL NAS transport message to UE including the payload containers and MANAGE UE POLICY COMMAND message, which includes the URSP rule-1 configured by the PCF. A PDU Session to the default DNN using the default S-NSSAI is established;
3. Start APP1 on the UE, or start an App simulator by appropriate tool. The UE matches the locally stored URSP rule-1 according to the APPID-1 and DNN1 provided by the APP1. The UE initiates a PDU session establishment request with the S-NSSAI, SSC mode and PDU session type obtained from the Route Selection Descriptor in URSP;
4. The NW sends PDU session establishment accept message to UE.

Table 23: Main Message Flow for Single URSP Rules -- Multiple Traffic Descriptors

Step	Direction UE - NW	Message	Comments
1	-->	REGISTRATION REQUEST	

	<--	REGISTRATION ACCEPT	Including Allowed NSSAI (S-NSSAI1 and S-NSSAI111), Configured NSSAI (S-NSSAI1 and S-NSSAI111)
2	<--	DL NAS transport	Including URSP rule-1: traffic descriptor (APPID-1, DNN1), route selection descriptor-1 (S-NSSAI1); URSP rule-3: traffic descriptor (match-all), route selection descriptor (S-NSSAI111)
	-->	PDU session establishment request	Including S-NSSAI111
	<--	PDU session establishment accept	
3	-->	PDU session establishment request	Including S-NSSAI1
4	<--	PDU session establishment accept	

4.2.10.3.4 Success Criteria

UE selects specified PDU session for service by matching the URSP rule:

Step 2: The DL NAS TRANSPORT received by the UE contains the payload containers and MANAGE UE POLICY COMMAND message, which includes the URSP rule-1 configured by the PCF. UE can successfully store the URSP rule-1 received from the network.

Step 3: The APP ID-1 and DNN1 provided by the APP1 can match the URSP rule-1. The APPID-1 and DNN1 provided by the APP1 are the same as the traffic descriptor APPID and DNN in the URSP rule-1. By matching the URSP rule-1 with APPID-1 and DNN1, UE can obtain the associated S-NSSAI in route selection descriptor-1 in URSP rule-1. And UE initiates the establishment of a new PDU session with the S-NSSAI obtained from the URSP rule-1. The SSC mode, S-NSSAI or PDU session type of the new established PDU session is the same as these parameters in Route Selection Descriptor-1 in URSP rule-1. This application service can be used normally on the new established PDU

session. And checking the service can run in the correct PDU session in network slice S-NSSAI rather than the default network slice.

4.2.10.4 Multiple URSP rules --- Concurrency of Multiple Services

4.2.10.4.1 Test Objective

The purpose of this test case is to verify the network and 5G devices can support multiple services access multiple network slices at the same time.

4.2.10.4.2 Pre-configuration

NW:

- The hardware platform is powered on and the working status is normal;
- The UEs, AMF, UDM and other network elements all support the network slicing function;
- The UE has subscribed for S-NSSAI1, S-NSSAI2, S-NSSAI111 (default). The PCF is configured with UE policies. At least two or more URSP rules should be configured at the same time. URSP rule-1 includes traffic descriptor APPID-1 and the corresponding Route Selection Descriptor-1 including S-NSSAI1. URSP rule-2 include traffic descriptor DNN2 and the corresponding Route Selection Descriptor-2 including S-NSSAI2;
- APP1 in UE has subscribed for network slice S-NSSAI1, and APP2 in UE has subscribed for network slice S-NSSAI2;
- A signalling analysis tool and packet capture environment have been created on the AMF and N3 (or UPF).

UE:

- The UE is switched on;
- The test application is installed in the UE. APP1 can match URSP rule-1 with APPID-1. APP2 can match URSP rule-2 with DNN2.

4.2.10.4.3 Test Procedure

1. Step 2-4 in 4.2.1.3 are performed;
2. The NW sends a DL NAS transport message to UE including the payload containers and MANAGE UE POLICY COMMAND message, which includes the URSP rule-1 and URSP rule-2 configured by the PCF. A PDU Session to the default DNN using the default S-NSSAI is established;

3. Start APP1 on the UE, or start an App simulator by appropriate tool. The UE matches the locally stored URSP rule-1 according to the APP ID-1 provided by the APP1. The UE initiates a PDU session establishment request with the S-NSSAI1, SSC mode and PDU session type obtained from the Route Selection Descriptor in URSP;
4. The NW sends PDU session establishment accept message to UE;
5. For the second service:
 - a) Case 1 (two internet type services): Start APP2 on the UE, or start an App simulator by appropriate tool. The UE matches the locally stored URSP rule-2 according to the DNN2 provided by the APP2. The UE initiates a PDU session establishment request with the S-NSSAI2, SSC mode and PDU session type obtained from the Route Selection Descriptor in URSP;
 - b) Case 2 (one internet type service and one IMS type service): UE initiates an IMS call, checking whether a corresponding PDU session with DNN2 and S-NSSAI2 is established.
6. The NW sends PDU session establishment accept message to UE.

Table 24: Main Message Flow for Multiple URSP Rules -- Concurrency of Multiple Services

Step	Direction UE - NW	Message	Comments
1	-->	REGISTRATION REQUEST	
	<--	REGISTRATION ACCEPT	Including Allowed NSSAI (S-NSSAI1, S-NSSAI2 and S-NSSAI111), Configured NSSAI (S-NSSAI1, S-NSSAI2 and S-NSSAI111)
2	<--	DL NAS transport	Including URSP rule-1: traffic descriptor (APPID-1), route selection descriptor-1 (S-NSSAI1); URSP rule-2: traffic descriptor (DNN2), route selection descriptor-1 (S-NSSAI2); URSP rule-3: traffic descriptor (match-all), route selection descriptor (S-NSSAI111)

	-->	PDU session establishment request	Including S-NSSAI111
	<--	PDU session establishment accept	
3	-->	PDU session establishment request	Including S-NSSAI1
4	<--	PDU session establishment accept	
5	-->	PDU session establishment request	Both case 1 and case 2 are including S-NSSAI2
6	<--	PDU session establishment accept	

4.2.10.4.4 Success Criteria

UE selects specified PDU session for service by matching the URSP rule:

Step 2: The DL NAS TRANSPORT received by the UE contains the payload containers and MANAGE UE POLICY COMMAND message, which includes the URSP rule-1 and URSP rule-2 configured by the PCF. UE can successfully store the URSP received from the network;

Step 3: The APP ID-1 provided by the APP1 is the same as the traffic descriptor APP ID in one of the URSP rule-1. By matching the URSP rule-1 with APP ID-1, UE and can obtain the associated S-NSSAI1 in URSP rule-1. And UE initiates the establishment of a new PDU session with the S-NSSAI1 obtained from the URSP rule-1. The SSC mode, S-NSSAI1 or PDU session type of the new established PDU session is the same as these parameters in Route Selection Descriptor-1 in URSP rule-1. This application service can be used normally on the new established PDU session. And checking the service can run in the correct PDU session in network slice S-NSSAI1 rather than the default network slice;

Step 5:

- a) Case 1: The DNN2 provided by the APP2 is the same as the traffic descriptor DNN in one of the URSP rule-2. By matching the URSP rule-2 with DNN2, UE and can obtain the associated S-NSSAI2 in URSP rule-2. And UE initiates the

establishment of a new PDU session with the S-NSSAI2 obtained from the URSP rule-2. The SSC mode, S-NSSAI2 or PDU session type of the new established PDU session is the same as these parameters in Route Selection Descriptor-2 in URSP rule-2. This application service can be used normally on the new established PDU session. And checking the service can run in the correct PDU session in network slice S-NSSAI2 rather than the default network slice or network slice S-NSSAI1;

- b) Case 2: The DNN2 of the IMS call is the same as the traffic descriptor DNN in URSP rule-2. UE initiates the establishment of a new PDU session with the S-NSSAI2 obtained from the URSP rule-2. Checking the service can run in the correct PDU session in network slice S-NSSAI2 rather than the default network slice or network slice S-NSSAI1.

The establishment of the second PDU session for APP2 does not affect the use of the first PDU session for APP1.

4.3 Interworking with EPC

4.3.1 Handover from 5GC to EPC

4.3.1.1 Test Objective

The purpose of this test case is to verify 5G devices with traffic associated PDU session with S-NSSAI could handover from 5GC to EPC, and the data transmission is kept continuity.

Please note that this case is designed with DNN based URSP rule as an example, and other Traffic Description also could be used.

4.3.1.2 Pre-configuration

NW:

- The hardware platform is powered on and the working status is normal;
- NR and LTE cell works normally, and PLMN of NR cell and LTE cell is same;
- The UEs, RAN, AMF, UDM, P-GW+SMF, PGW-U+UPF and other network elements all support the network slicing function;
- The N26 interface between AMF in 5GC and MME in EPC is supported;
- Other configurations could refer to 4.2.4.2 NW 3-5.

UE:

- The configuration could refer to 4.2.4.2 UE 1-3.

Note:

1. If use other Traffic description, the related UE configuration of 4.2.X.2 in which the related TD is used is referred to;
2. For the reference parameters of URSP rules, please see Table 11.

4.3.1.3 Test Procedure

1. UE camps on a NR cell and Step 1-5 in 4.2.4.3 are performed;
2. Lower NR cell signal level to trigger Handover process when the traffic of APP1 and APP2 is ongoing;
3. NW sends MobilityFromNRCommand to UE;
4. UE initiates TAU request in LTE;
5. NW sends TAU accept to UE;
6. UE sends TAU complete to NW and the traffic of APP1 and APP2 resumes.

Note:

If other traffic description is used, the related procedures step 1-5 of section 4.2.X.3 in which the related TD is used should be performed in step 1 of this case.

Table 25: Main Message Flow for Handover from 5GC to EPC

Step	Direction UE - NW	Message	Comments
1	-->	REGISTRATION REQUEST	Registration type "initial registration" not including Requested NSSAI
	<--	REGISTRATION ACCEPT	Not including any NSSAI
	-->	PDU SESSION ESTABLISHMENT REQUEST	Default PDU with S-NSSAI-111
	<--	PDU SESSION ESTABLISHMENT ACCEPT	"Mapped EPS bearer contexts" included and EPI=ebi_number2
	-->	PDU SESSION ESTABLISHMENT REQUEST	APP1 triggered PDU with S-NSSAI1

	<--	PDU SESSION ESTABLISHMENT ACCEPT	"Mapped EPS bearer contexts" included and EPI=ebi_number1
3	<--	MobilityFromNRCommand	
4	-->	TRACKING AREA UPDATE REQUEST	"EPS bearer context status" included and bears with ebi_number1& ebi_number2 indicate active
5	<--	TRACKING AREA UPDATE ACCEPT	"EPS bearer context status" included and bears with ebi_number1& ebi_number2 indicate active
6	-->	TRACKING AREA UPDATE COMPLETEs	

4.3.1.4 Success Criteria

UE selects specified PDU session for service by matching the URSP rule in NR and Handover from 5GC to EPC with PDU being mapped to PDN, the traffic keeps continuous for both APP:

Step 1: The "Mapped EPS bearer contexts" with EBI = ebi_number1 is included in the PDU SESSION ESTABLISHMENT ACCEPT message for the PDU session triggered by APP1, and "Mapped EPS bearer contexts" with EBI = ebi_number2 is included in the related accept message for the PDU session which the traffic of APP2 is transmitted in;

Step 4: "EPS bearer context status" is included in the EMM Tracking Area Update message and the EPS bear with ebi_number1 and EPS bear with ebi_number2 which set in step1 are indicated active;

Step 5: "EPS bearer context status" is included in the EMM Tracking Area accept message and the EPS bear with epi_number1 and EPS bear with ebi_number2 which set in step1 are indicated active;

Check if packets for APP1 and APP2 are transmitted and received over the corresponding PDN connections respectively.

Note:

1. The case 4.2.4 should pass before this case;
2. If other Traffic description is used, the related case in which case the related TD is used in 4.2 should pass before this case.

4.3.2 Redirection from EPC to 5GC

4.3.2.1 Test Objective

The purpose of this test case is to verify 5G devices with traffic setup in LTE could be redirected from EPC to 5GC, and the data transmission is kept continuity.

Note: this case is designed with DNN based URSP rule as an example, and other Traffic Description also could be used.

4.3.2.2 Pre-configuration

NW:

- The hardware platform is powered on and the working status is normal;
- LTE cell works normally, NR cell's signal is weak to make UE cannot camp on and there is no 3G or 2G neighbour cell; PLMN of NR cell and LTE cell is same;
- The UEs, RAN, AMF, UDM, P-GW+SMF, PGW-U+UPF and other network elements all support the network slicing function;
- The N26 interface between AMF in 5GC and MME in EPC is supported;
- Other configurations could refer to 4.2.4.2 NW 3-5.

UE:

- The configuration could refer to 4.2.4.2 UE 1-3.

Note:

1. If use other Traffic description, the related UE configuration of 4.2.X.2 in which the related TD is used is referred to;
2. For the reference parameters of URSP rules, please see Table 11.

4.3.2.3 Test Procedure

1. UE camps on an LTE cell and sends the Attach Request together with PDN CONNECTIVITY REQUEST. The PDN CONNECTIVITY REQUEST message includes PDU session identity within PCO;

2. NW send the ATTACH ACCEPT message together with an ACTIVATE DEFAULT EPS BEARER CONTEXT REQUEST message to UE. The ACTIVATE DEFAULT EPS BEARER CONTEXT REQUEST message includes PCO message with S-NSSAI-111;
3. UE sends an ATTACH COMPLETE message together with an ACTIVATE DEFAULT EPS BEARER CONTEXT ACCEPT;
4. Start APP2 on the UE, or start an App simulator by appropriate tool;
5. Start APP1 on the UE, or start an App simulator by appropriate tool;
6. Lower LTE cell signal level and raise NR cell signal level to trigger redirection process when the traffic of APP1 and APP2 is ongoing;
7. NW sends RRCConnectionRelease message to UE;
8. UE initiates REGISTRATION REQUEST with registration type “mobility registration updating” in NR;
9. NW sends a REGISTRATION ACCEPT message to UE and the traffic of APP1 and APP2 resumes.

Table 26: Main Message Flow for Redirection from EPC to 5GC

Step	Direction UE - NW	Message	Comments
1	-->	ATTACH REQUEST	Together with a PDN CONNECTIVITY REQUEST message including PDU session identity
2	<--	ATTACH ACCEPT	Together with an ACTIVATE DEFAULT EPS BEARER CONTEXT REQUEST message with EPS bearer identity
3	-->	ATTACH COMPLETE	Together with an ACTIVATE DEFAULT EPS BEARER CONTEXT ACCEPT message
7	<--	RRCConnectionRelease	Used in case of redirection
8	-->	REGISTRATION REQUEST	The “PDU session status” is included
9	<--	REGISTRATION ACCEPT	The “PDU session status” is included

4.3.2.4 Success Criteria

UE setups EPS bearer with which traffic of APP1 and APP2 is associated in LTE, and performs redirection from EPC to 5GC with eps bearer being mapped to PDU session, the traffic keeps continuous for both APP:

- Step 1: "PDU session ID" with PSI = psi_number_x is included in the PDN CONNECTIVITY REQUEST message;
- Step 2: "EPS bearer identity" with EBI = ebi_number_x and S-NSSAI-111 within "Protocol Configuration Options" are included in the ACTIVATEDefault EPS BEARER CONTEXT REQUEST message;
- Step 4: No new PDN connectivity request is triggered;
- Step 5: No new PDN connectivity request is triggered;
- Step 7: UE receives RRCConnectionRelease message with Redirection information;
- Step 8: "PDU session status" is included in the REGISTRATION REQUEST message and the PDU SESSION with psi_number_x which set in step1 is indicated active; the S-NSSAI-111 is included in the requested NSSAI within the REGISTRATION REQUEST message;
- Step 9: "PDU session status" is included in the REGISTRATION ACCEPT message and the PDU SESSION with psi_number_x is indicated active;
- After step 9, packets for APP1 and APP2 are transmitted and received with the same PDU SESSION associated with the S-NSSAI111 normally.

4.3.3 Handover from EPC to 5GC

4.3.3.1 Test Objective

The purpose of this test case is to verify 5G devices with traffic setup in LTE could be redirected or handover from EPC to 5GC, and the data transmission is kept continuity.

Please note that this case is designed with DNN based URSP rule as an example, and other Traffic Description also could be used.

4.3.3.2 Pre-configuration

The pre-configuration is the same as 4.3.2.2.

4.3.3.3 Test Procedure

1. The procedures are the same as the case 4.3.2 except step 7;

2. Step 7 NW sends MobilityFromEUTRACommand message to UE in handover procedure.

Table 27: Main Message Flow for Handover from EPC to 5GC

Step	Direction UE - NW	Message	Comments
1-6		...	Refer to 4.3.2.3 step 1-6
7	<--	MobilityFromEUTRACommand	Used in case of handover
8-9		...	Refer to 4.3.2.3 step 8-9

4.3.3.4 Success Criteria

The success criteria are the same as 4.3.2.4 except the step 7:

Step 7: UE receives MobilityFromEUTRACommand message.

4.3.4 Handover from 5GC to EPC, then Redirection back to 5GC

4.3.4.1 Test Objective

The purpose of this test case is to verify 5G devices with traffic associated PDU session with S-NSSAI could handover from 5GC to EPC, then be redirected back to 5GC, and the data transmission is kept continuity.

Please note that this case is designed with DNN based URSP rule as an example, and other Traffic Description also could be used.

4.3.4.2 Pre-configuration

NW:

- The hardware platform is powered on and the working status is normal;
- NR and LTE cell works normally and there is no 3G or 2G neighbour cell; PLMN of NR cell and LTE cell is same;
- The UEs, RAN, AMF, UDM, P-GW+SMF, PGW-U+UPF and other network elements all support the network slicing function;
- The N26 interface between AMF in 5GC and MME in EPC is supported;
- Other configurations could refer to 4.2.4.2 NW 3-5.

UE:

- The configuration could refer to 4.2.4.2 UE 1-3.

Note:

1. If use other Traffic description, the related UE configuration of 4.2.X.2 in which the related TD is used is referred to;
2. For the reference parameters of URSP rules, please see Table 11.

4.3.4.3 Test Procedure

1. UE camps on a NR cell and Step 1-5 in 4.2.4.3 are performed;
2. Lower NR cell signal level to trigger Handover process when the traffic of APP1 and APP2 is ongoing;
3. NW sends MobilityFromNRCommand to UE;
4. UE initiates TAU request in LTE;
5. NW sends TAU accept to UE;
6. UE sends TAU complete to NW and the traffic of APP1 and APP2 resumes;
7. Lower LTE cell signal level and raise NR cell signal level to trigger redirection process when the traffic of APP1 and APP2 is ongoing;
8. NW sends RRCConnectionRelease message to UE;
9. UE initiates REGISTRATION REQUEST with registration type “mobility registration updating” in NR;
10. NW sends a REGISTRATION ACCEPT message to UE and the traffic of APP1 and APP2 resumes.

Note:

If other traffic description is used, the related procedures step 1-5 of section 4.2.X.3 in which the related TD is used should be performed in step 1 of this case.

Table 28: Main Message Flow for Handover from 5GC to EPC, then Redirection back to 5GC

Step	Direction UE - NW	Message	Comments
1	-->	REGISTRATION REQUEST	Registration type “initial registration” not including Requested NSSAI
	<--	REGISTRATION ACCEPT	Not including any NSSAI

	-->	PDU SESSION ESTABLISHMENT REQUEST	Default PDU with S-NSSAI-111
	<--	PDU SESSION ESTABLISHMENT ACCEPT	"Mapped EPS bearer contexts" included and EBI = ebi_number2
	-->	PDU SESSION ESTABLISHMENT REQUEST	APP1 triggered PDU with S-NSSAI1
	<--	PDU SESSION ESTABLISHMENT ACCEPT	"Mapped EPS bearer contexts" included and EBI = ebi_number1
3	<--	MobilityFromNRCommand	
4	-->	TRACKING AREA UPDATE REQUEST	"EPS bearer context status" included and bears with ebi_number1 & ebi_number2 indicate active
5	<--	TRACKING AREA UPDATE ACCEPT	"EPS bearer context status" included and bears with ebi_number1 & ebi_number2 indicate active
6	-->	TRACKING AREA UPDATE COMPLETEs	
8	<--	RRCCConnectionRelease	Used in case of redirection
9	-->	REGISTRATION REQUEST	The "PDU session status" is included

10	<--	REGISTRATION ACCEPT	The "PDU session status" is included
----	-----	---------------------	--------------------------------------

4.3.4.4 Success Criteria

UE selects specified PDU session for service by matching the URSP rule in NR and Handover from 5GC to EPC with PDU being mapped to PDN, then performs redirection or handover from EPC to 5GC with eps bearer being mapped to PDU session, the traffic keeps continuous for both APP:

Step 1: The "Mapped EPS bearer contexts" with EBI = ebi_number1 is included in the PDU SESSION ESTABLISHMENT ACCEPT message for the PDU session with psi_number1 triggered by APP1, and "Mapped EPS bearer contexts" with EBI = ebi_number1 is included in the related accept message for the PDU session with psi_number2 which the traffic of APP2 is transmitted in;

Step 4: "EPS bearer context status" is included in the EMM Tracking Area Update message, the EPS bear with ebi_number1 and EPS bear with ebi_number2 which set in step1 are indicated active;

Step 5: "EPS bearer context status" is included in the EMM Tracking Area accept message, the EPS bear with ebi_number1 and EPS bear with ebi_number2 which set in step1 are indicated active;

Step 7: Check if packets for APP1 and APP2 are transmitted and received over the corresponding PDN connections respectively;

Step 8: UE receives RRCConnectionRelease message with Redirection information;

Step 9: "PDU session status" is included in the REGISTRATION REQUEST message and the PDU SESSION with psi_number1, PDU SESSION with psi_number2 which set in step1 is indicated active; the S-NSSAI-111, S-NSSAI-111 are included in the requested NSSAI within the REGISTRATION REQUEST message;

Step10: "PDU session status" is included in the REGISTRATION ACCEPT message, the PDU SESSION with psi_number1 and the PDU SESSION with psi_number2 are indicated active;

After step10, packets for APP1 and APP2 are transmitted and received normally.

Note:

1. The case 4.2.4 should pass before this case;

2. If other Traffic description is used, the related case in which case the related TD is used in 4.2 should pass before this case.

4.3.5 Handover from 5GC to EPC, then Handover back to 5GC

4.3.5.1 Test Objective

The purpose of this test case is to verify 5G devices with traffic associated PDU session with S-NSSAI could handover from 5GC to EPC, then handover back to 5GC, and the data transmission is kept continuity.

Please note that this case is designed with DNN based URSP rule as an example, and other Traffic Description also could be used.

4.3.5.2 Pre-configuration

The pre-configuration is the same as 4.3.4.2.

4.3.5.3 Test Procedure

1. The procedures are the same as the case 4.3.4 except step 8;
2. In step 8, NW sends MobilityFromEUTRACommand message to UE.

Table 29: Main Message Flow for Handover from 5GC to EPC, then Handover back to 5GC

Step	Direction UE - NW	Message	Comments
1-7		...	Refer to 4.3.4.3 step 1-7
8	<--	MobilityFromEUTRACommand	Used in case of handover
9-10		...	Refer to 4.3.4.3 step 9-10

4.3.5.4 Success Criteria

The success criteria are the same as 4.3.4.4 except step 8:

Step 8: UE receives MobilityFromEUTRACommand.

5 SERVICE SPECIFIC REQUIREMENTS FOR NETWORK SLICING TRIAL

5.1 FTP/Speedtest Download Service

5.1.1 Test Objective

The purpose of this test case is to test whether the network slicing technology can improve the download speed of services that require high throughput, like FTP download or Speedtest Applications and to improve UE download performance of FTP, speedtest services in an overloaded network with a dedicated slice to UE.

5.1.2 Pre-configuration

NW:

- 5GC Cell A belongs to Home PLMN;
- Two slices (NSSAI #1 and #2) are configured on gNodeB for same TAC (that Cell A belongs to) and 5GC;
- No dedicated air interface resource (Resource blocks) has been assigned to Slices;
- Two different Subscribed/Allowed/Configured NSSAIs (that are signalled by gNodeB during NG SETUP) are configured for three different USIMs on 5GC. One USIM is assigned to first slice and two USIMs are assigned to second slice;
- 1 IPERF server and 1 FTP server and/or 1 Speedtest server (e.g. Ookla App) and are ready.

UE:

- One test UE with USIM inserted (having S-NSSAI #1) should be ready;
- Two test UE with USIM inserted (having S-NSSAI #2) should be ready;
- The UE states are Switched OFF;
- 3 UEs are located at good radio conditions (e.g. cell-centre).

5.1.3 Test Procedure

1. UE1 registers and sets up a PDU Session on Slice #1 at Cell A;
2. UE2 and UE3 register and set up a PDU Session on Slice #2 at Cell A;
3. UE2 and UE3 start UDP download on Iperf server with full buffer traffic;

- a) Total UDP downlink speed bandwidth can be arranged such that 2 UE UDP traffic covers approximately more than %90 of cell max DL capacity (e.g. 650 Mbps DL UDP to each UE on a 100 MHz BW, 4x4MIMO and 256 QAM C-Band Cell);
- b) In order to create DL UDP traffic, the following iperf commands can be run on IPERF server (e.g. 650 Mbps DL UDP for 60 seconds):

```
iperf -c <UE2 PDU IP> -u -b 650m -t 60
```

```
iperf -c <UE3 PDU IP> -u -b 650m -t 60
```
4. UE1 starts downlink FTP or speedtest traffic;
5. Stop all UE traffic;
6. Assign dedicated resources for Slice#1 in Cell A (e.g. some percentage like %50 of RB's) and no dedicated resource for Slice#2;
7. Repeat step 3;
8. Repeat step 4.

5.1.4 Success Criteria

1. After step 4 observe UE1 FTP or Speedtest App DL throughput;
2. After step 8 observe UE1 FTP or Speedtest App DL throughput;
3. Compare the FTP or Speedtest App DL throughputs between step 4 and 8 and observe that the DL throughput after step 8 is much higher.

5.2 Video Service

5.2.1 Test Objective

The purpose of this test case is to verify whether the performance of video service with a dedicated slice on an overloaded network can be improved.

5.2.2 Pre-configuration

NW:

- 5GC Cell A belongs to Home PLMN;
- The hardware platform is powered on and the working status is normal;
- The UEs, AMF, UDM and other network elements all support the network slicing function;

- Subscribed S-NSSAIs (S-NSSAI1, S-NSSAI111 (default)) are configured for UE1. Network slice S-NSSAI1 is configured for APP1, and no dedicated network slice is configured for APP2 in UE1;
- No dedicated network slice is configured for UE2 and UE3;
- Assign dedicated resources for S-NSSAI1 (e.g. some percentage like 50% of RB's), and no dedicated resource is assigned for S-NSSAI111;
- The network is overloaded. The overloaded network is constructed according to 5.1.3 step 3;
- A signalling analysis tool and packet capture environment have been created on the AMF and N3 (UPF).

UE:

- The UE1 is switched on;
- At least two video service APPs can be implemented in the UE1. APP1 can match URSP rule-1 with APPID-1. APP2 cannot match any URSP rules except the default URSP rule (with match-all traffic descriptor) with APP ID-2;
- APP1 in UE1 can be implemented in dedicated slice S-NSSAI1. APP2 in UE1 can be implemented in default slice S-NSSAI111;
- UE2 and UE3 can be implemented in default slice S-NSSAI111.

5.2.3 Test Procedure

1. Step 2-4 in 4.2.1.3 are performed;
2. The NW sends a DL NAS transport message to UE1 including the payload containers and MANAGE UE POLICY COMMAND message which contains the URSP configured by the PCF. A PDU Session to the default DNN using the default S-NSSAI is established;
3. Start the video service APP2 on the UE1;
4. Start the video service APP1 on the UE1;
5. Split the screen of UE1 for APP1 and APP2, so that two APPs can be displayed on the screen at the same time.

5.2.4 Success Criteria

Step 3: APP2 video service can be implemented normally in default network slice S-NSSAI111. Observe the latency t_2 of APP2 video service;

Step 4: APP1 video service can be implemented normally in network slice S-NSSAI1. Observe the latency t_1 of APP1 video service;

Step 5: Compare the performance of APP1 and APP2, the video performance of APP1 is better than APP2, i.e. video of APP1 is smoother than APP2, and no buffering is required for APP1. The latency of these two services is $t_1 < t_2$.

5.3 Cloud Gaming Service

5.3.1 Test Objective

The purpose of this test case is to verify whether the performance of cloud gaming service with a dedicated slice on an overloaded network can be improved.

5.3.2 Pre-configuration

NW:

- 5GC Cell A belongs to Home PLMN;
- The hardware platform is powered on and the working status is normal;
- The UEs, AMF, UDM and other network elements all support the network slicing function;
- Subscribed S-NSSAIs (S-NSSAI1, S-NSSAI111 (default)) are configured for UE1. Network slice S-NSSAI1 is configured for APP1, and no dedicated network slice is configured for APP2 in UE1;
- No dedicated network slice is configured for UE2 and UE3;
- Assign dedicated resources for S-NSSAI1 (e.g. some percentage like 50% of RB's), and no dedicated resource is assigned for S-NSSAI111;
- The network is overloaded. The overloaded network is constructed according to 5.1.3 step 3;
- A signalling analysis tool and packet capture environment have been created on the AMF and N3 (UPF).

UE:

- The UE1 is switched on;
- At least two cloud gaming service APPs can be implemented in the UE1. APP1 can match URSP rule-1 with APPID-1. APP2 cannot match any URSP rules except the default URSP rule (with match-all traffic descriptor) with APP ID-2;
- APP1 in UE1 can be implemented in dedicated slice S-NSSAI1. APP2 in UE1 can be implemented in default slice S-NSSAI111;
- UE2 and UE3 can be implemented in default slice S-NSSAI111.

5.3.3 Test Procedure

1. Step 2-4 in 4.2.1.3 are performed;
2. The NW sends a DL NAS transport message to UE1 including the payload containers and MANAGE UE POLICY COMMAND message which contains the URSP configured by the PCF. A PDU Session to the default DNN using the default S-NSSAI is established;
3. Start the cloud gaming service APP2 on the UE1;
4. Start the cloud gaming service APP1 on the UE1;
5. Split the screen of UE1 for APP1 and APP2, so that two APPs can be displayed on the screen at the same time.

5.3.4 Success Criteria

Step 3: APP2 cloud gaming service can be implemented normally in default network slice S-NSSAI111. Observe the latency t_2 of APP2 cloud gaming service;

Step 4: APP1 cloud gaming service can be implemented normally in network slice S-NSSAI1. Observe the latency t_1 of APP1 cloud gaming service;

Step 5: Compare the cloud gaming service of APP1 and APP2, the user experience of APP1 is better than APP2, i.e. the service is not stuck and no buffering is required for APP1. The latency of these two services is $t_1 < t_2$.

LIST OF ABBREVIATIONS

5GC	5G Core Network
AMF	Access and Mobility Management Function
DNN	Data Network Name
EBI	EPS Bearer Identity
EPC	Evolved Packet Core Network
EPS	Evolved Packet System
FQDN	Fully Qualified Domain Name
IMS	IP Multimedia Subsystem
LTE	Long Term Evolution
OS	Operating System
OS Id	OS Identity
PDN	Packet Data Network
NR	New Radio
NSSF	Network Slice Selection Function
NW	Network
PCF	Policy Control Function
RAN	Radio Access Network
SMF	Session Management Function
S-NSSAI	Single Network Slice Selection Assistance Information
TAU	Tracking Area Update
TD	Traffic Descriptor
UDM	Unified Data Management
UPSC	UE Policy Section Code
URSP	UE Route Selection Policy

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