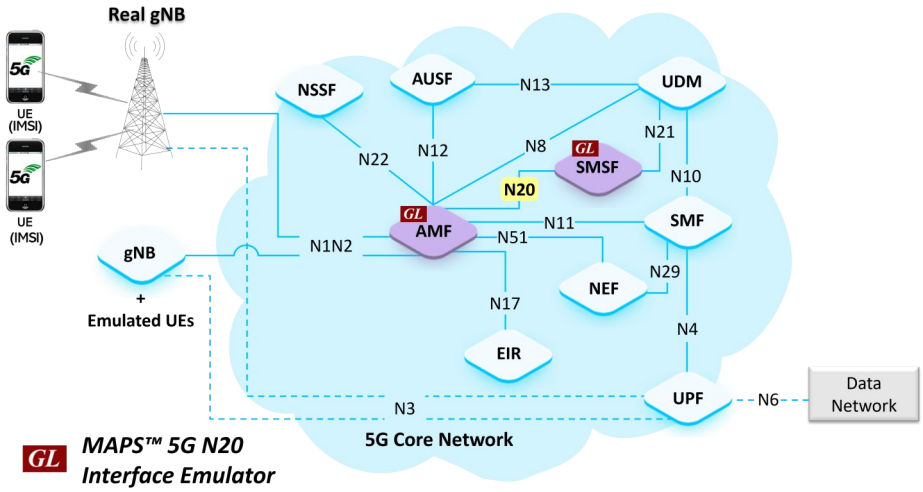
MAPS™ 5G N20 Interface Emulator Brochure



Overview

5G System as a Service Based Architecture, includes a set of Network Functions (NFs) providing services as defined in 3GPP TS 23.501 (Release 17). The service-based interfaces use HTTP/2 protocol with JavaScript Object Notation (JSON) as the application layer serialization protocol.

GL's MAPS™ emulate Short Message Service Function (SMSF) within the 5G core offering services to the Access and Mobility Management Function (AMF) via the Nsmsf service-based N20 interface. The above architecture represents the service based interfaces, with focus on the SMSF and AMF.

The AMF and SMSF are the entities present in 5G core network that supports Nsmsf_SMS and Namf_Communication Services. In N20 interface, both SMSF/AMF can act as "NF Producer", where SMSF producer refers to the Specification TS29.540 and AMF producer referred Namf Specifications TS29.518 (Release 17).

Besides emulating network elements SMSF and AMF functions, it also supports error tracking, regression testing, load testing. It can run pre-defined test scenarios against 5G interface test objects in a controlled and deterministic manner. Easy to use script syntax allows the user to create conformance test cases based on their test plan.

MAPS™ 5G N20 emulator supports powerful utilities such as Script Editor and Profile Editor which allows new scenarios to be created or existing scenarios to be modified using messages and parameters.

For more information, refer to MAPS™ 5G N20 Interface Emulator webpage.

Main Features

- Emulate SMSF and AMF network function
- Following are the supported services
  - Nsmsf_SMService: Activate, Deactivate and UplinkSMS (MOSMS)
  - Namf_Communication : N1N2MessageTransfer(UE Specific) operations based on N20 interface
- Services use REST APIs based on HTTP and JSON data format
- Supports Command Line Interface (CLI) through a client-server model, enabling users to control all features via Python APIs
- Supports TLS and TCP transports
- Offers NF service consumer to authorize SMS and activate SMS for a service via Nsmsf service on N20 interface
- Supports customization of call flow and message templates using Script and JSON Messages
- Ready-to-use scripts for quick testing
- Provides Call Statistics and Events Status
- Automation, Remote access, and Schedulers to run tests 24/7

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Testbed Configuration

The testbed setup window allows users to setup the required test configurations in N20 interface. It includes a list of variables that are declared and assigned before starting the script. Testbed Setup defines the MAPS™ parameters which communicates with the rest of the test network. End user configuration profile is used to configure MAPS™ 5G N20 interface with the supported AMF and SMSF parameters.

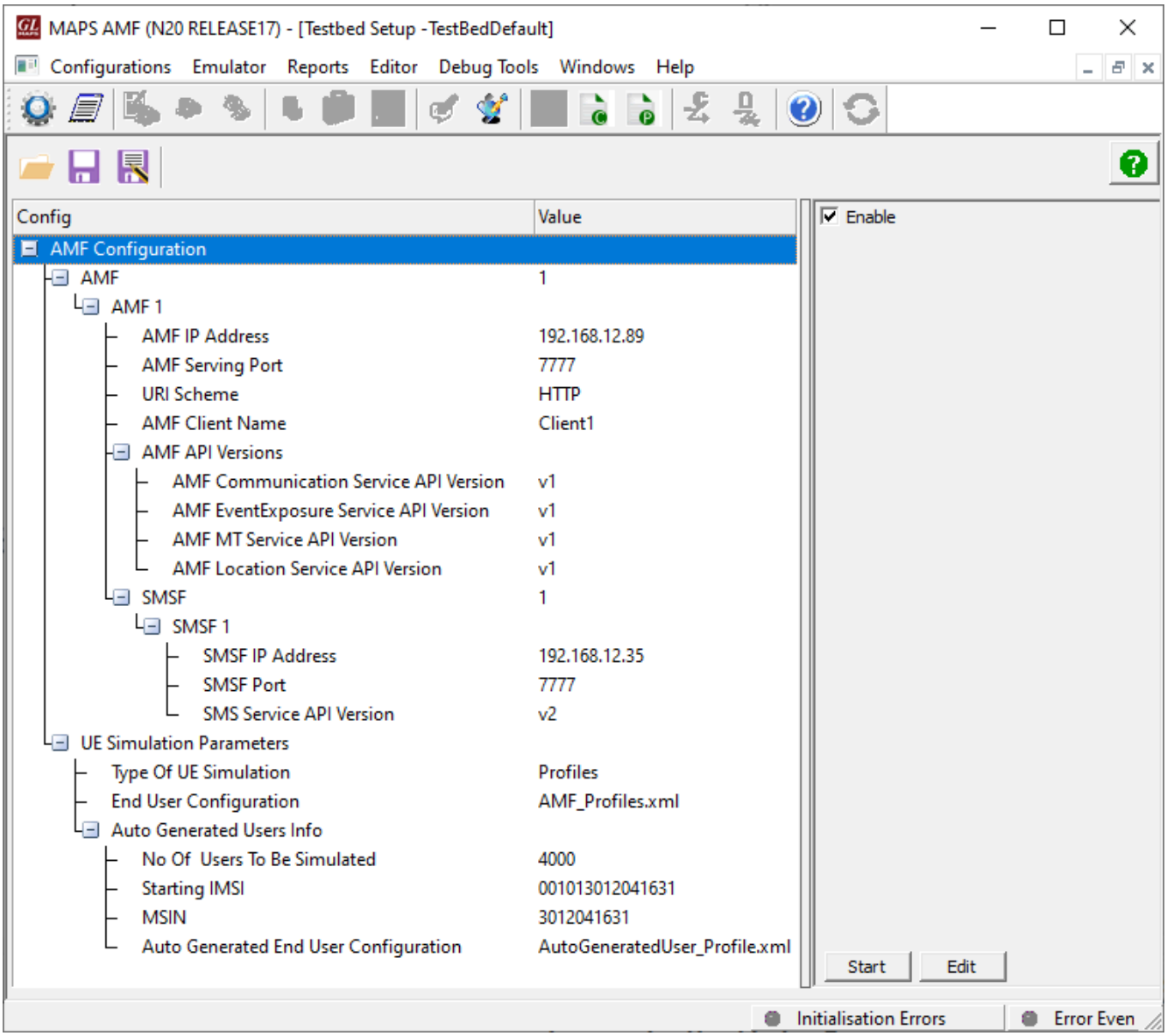


Figure: Testbed Setup

Pre-processing Tools

SCRIPT EDITOR - The script editor allows user to create/edit scripts and access protocol fields as variables for the message template parameters. The script uses pre-defined message templates, to perform send and receive actions.

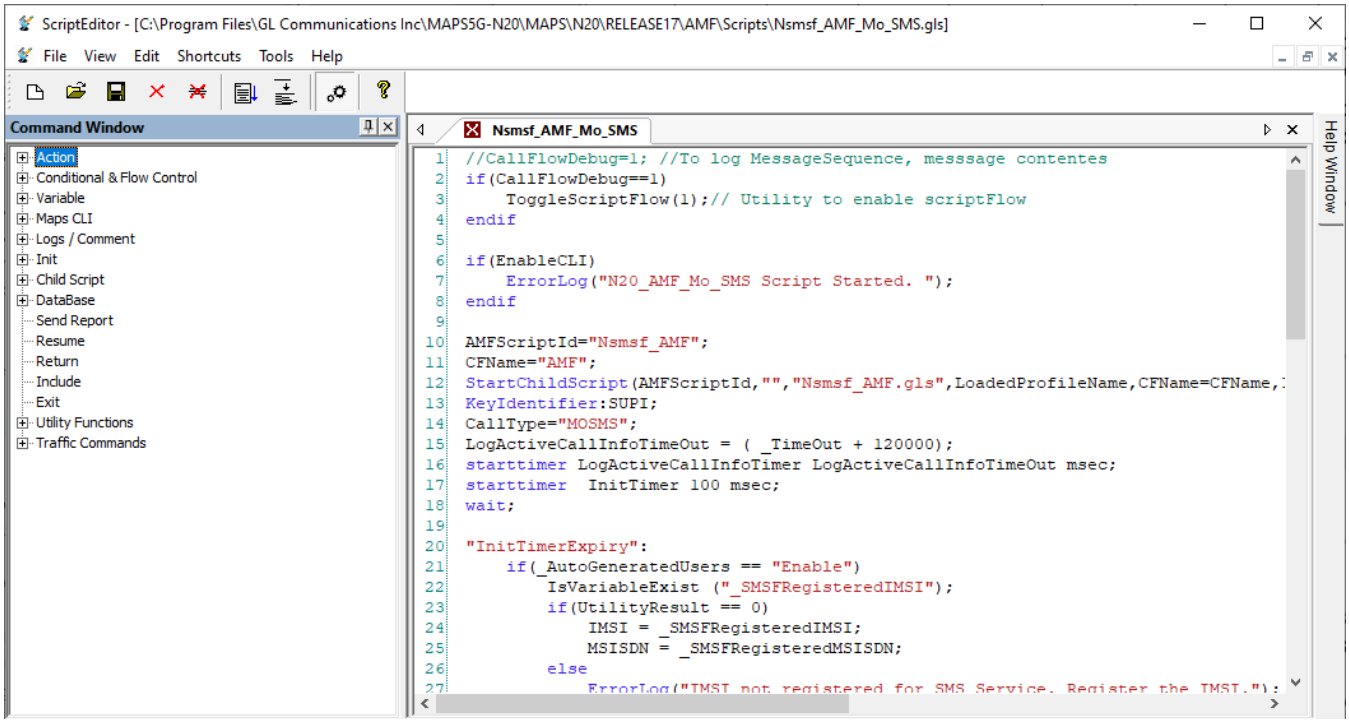


Figure: Script Editor

PROFILE EDITOR - This feature allows loading profile to edit the values of variables using GUI, replacing the original value of variables in the message template. An XML file defines a set of multiple profiles with varying parameter values which allows users to configure call instances in call generation to receive calls. These Profiles includes 5G parameters, that is required to configure multiple UEs to emulate Signaling and Traffic.

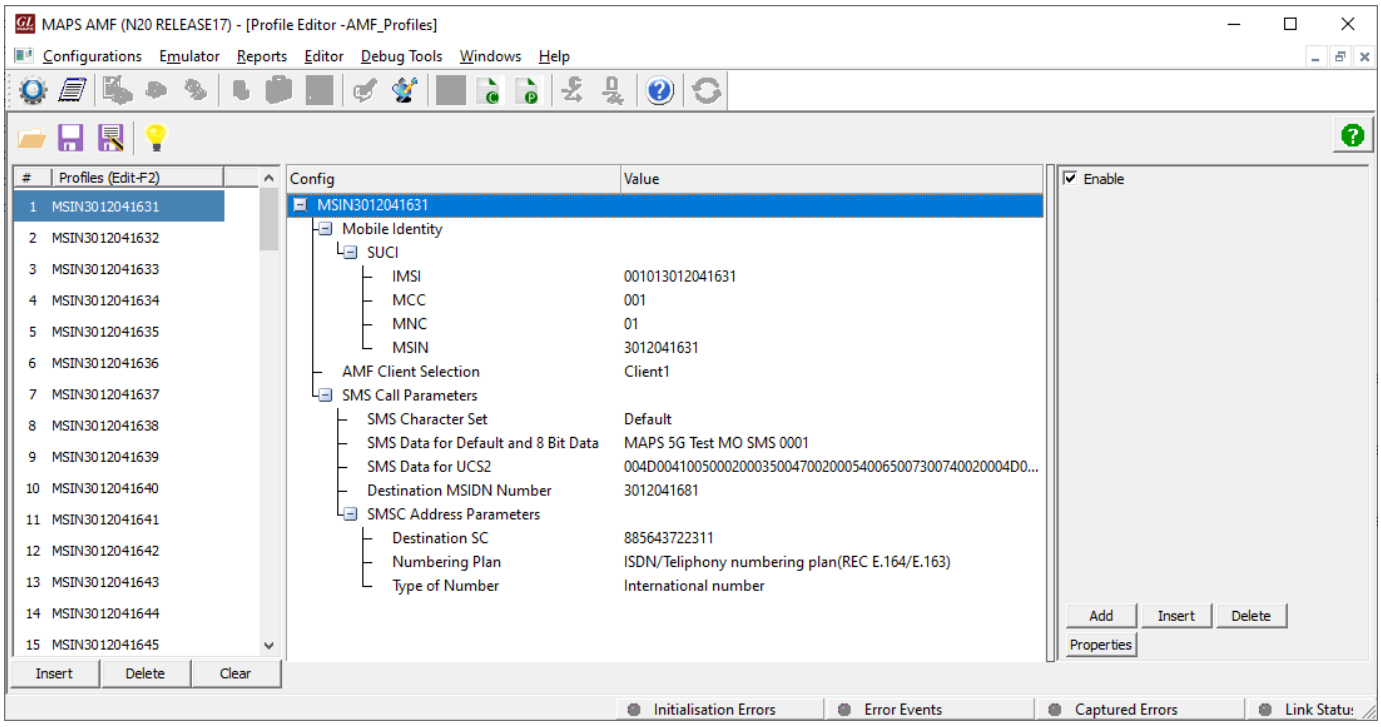


Figure: Profile Editor

Call Generation and Reception

In call generation mode, MAPS™ is configured for the outgoing messages, while in call receive mode, it is configured to respond to the incoming messages. Tests can be configured to run once, multiple iterations and continuously. Also, allows users to create multiple entries using quick configuration feature. The editor allows to run the added scripts sequentially (order in which the scripts are added in the window) or randomly (any script from the list of added script as per the call flow requirements).

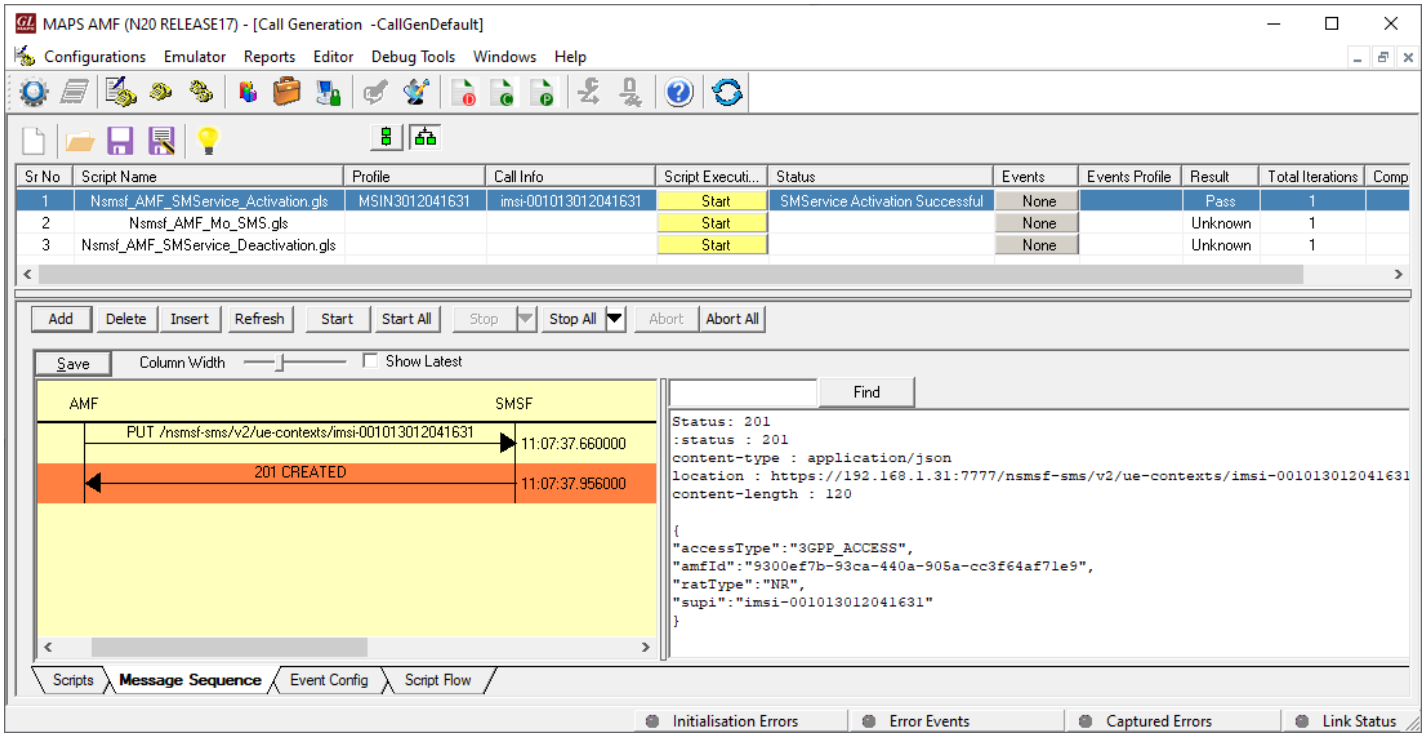


Figure: Call Generation

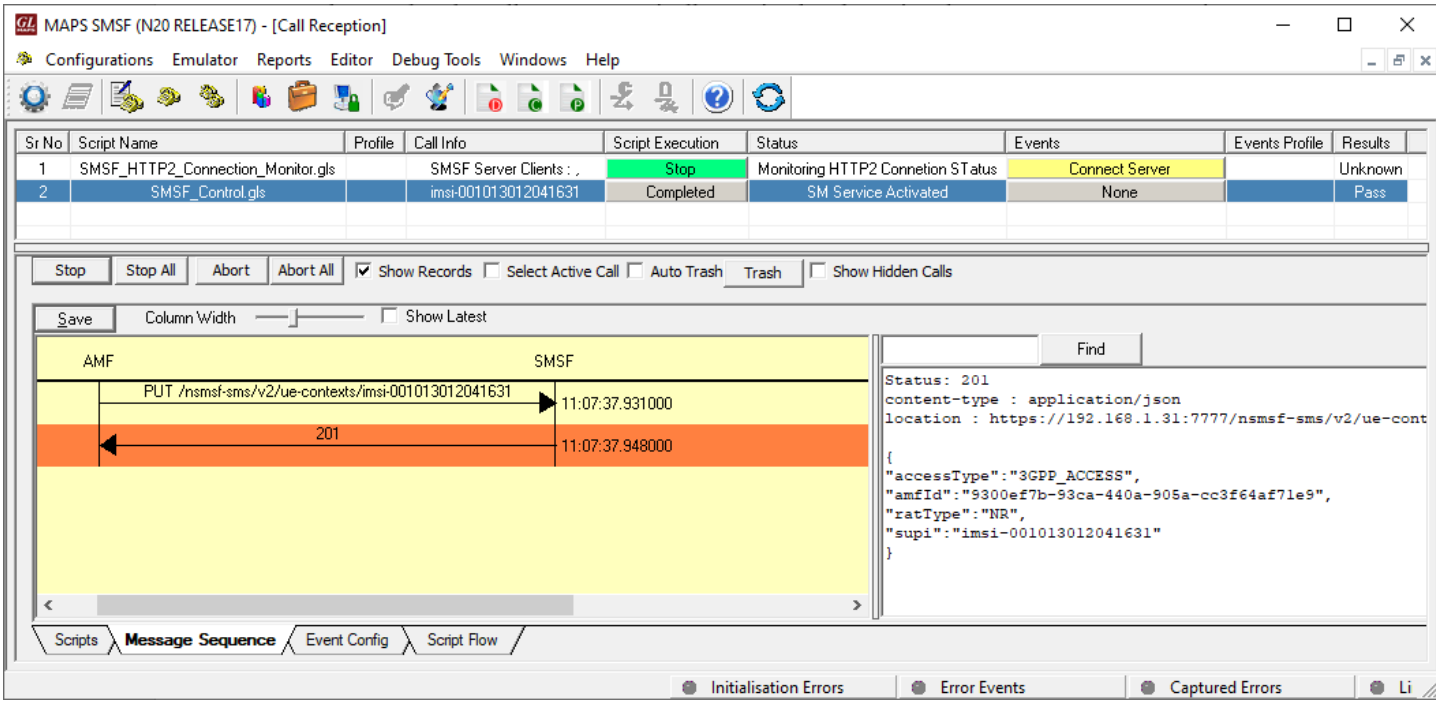


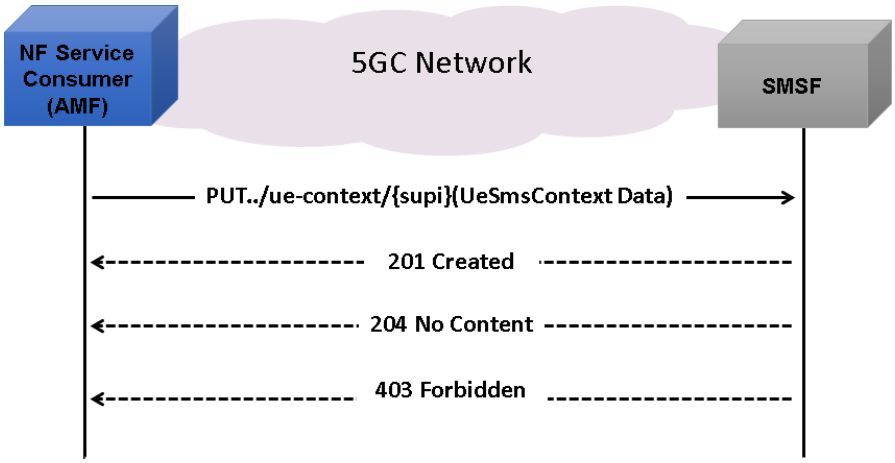
Figure: Call Reception

Nsmsf_SMService Procedures

Registration using Activate Service Procedure

MAPS™ for N20 interface emulate services between SMSF and AMF network functions.

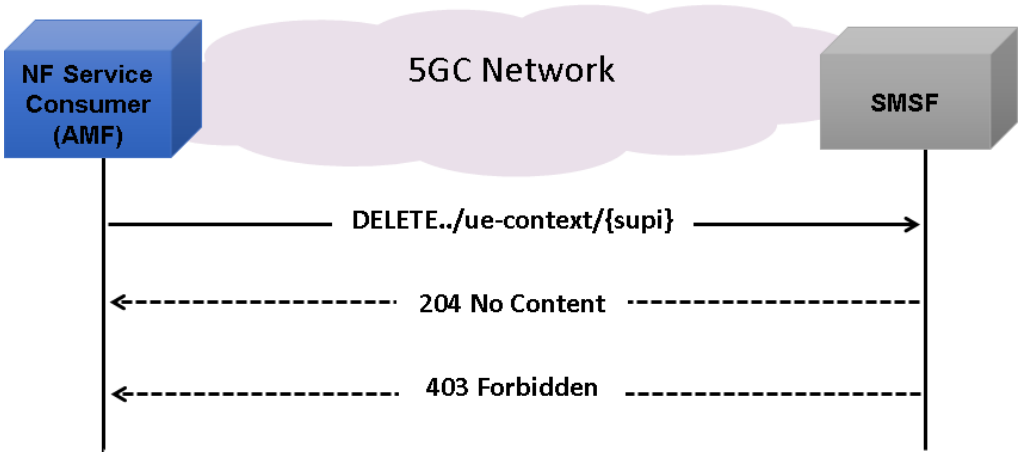
The NF Service Consumer (e.g. AMF) shall activate SMS service for a given service user by using the HTTP PUT method as shown below.



- The NF Service Consumer (AMF) shall send a PUT request to the resource representing the UE Context for SMS
- If the target UE Context for SMS is not created in SMSF, the SMSF retrieves subscription data from the UDM, performs service authorization for the given UE, and create UE Context for SMS for this UE
- If successful, "201 Created" shall be returned
- If the target UE Context for SMS has already been created, the SMSF updates the UE Context for SMS with the NF Service Consumer (e.g. AMF) provided parameters
- If successful, "204 No Content" shall be returned
- On failure, the appropriate HTTP status code (e.g. "403 Forbidden") indicating the error shall be returned

De-Registration using Deactivate Service Procedure

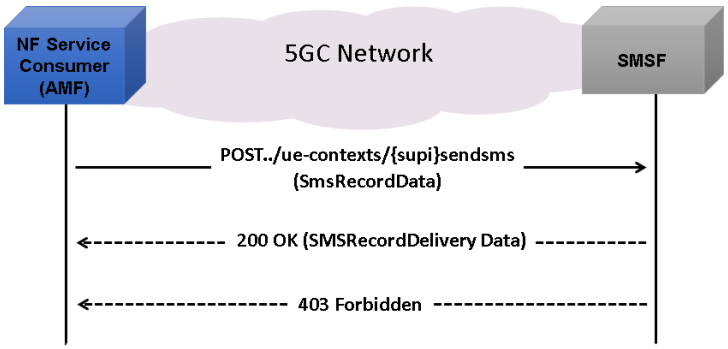
The NF Service Consumer (e.g. AMF) shall deactivate SMS service for a given service user by using the HTTP DELETE method as shown below.



- AMF sends a DELETE request to the SMSF representing the UE's to deactivate SMS service for an user
- On success, "204 No Content" is returned
- If the operation cannot be authorized then HTTP status code "403 Forbidden" should be returned

Send SMS payload in Uplink Direction Procedure

In this procedure the AMF uses UplinkSMS service operation to send SMS payload (e.g. SMS message or Ack) in the uplink direction to SMSF.

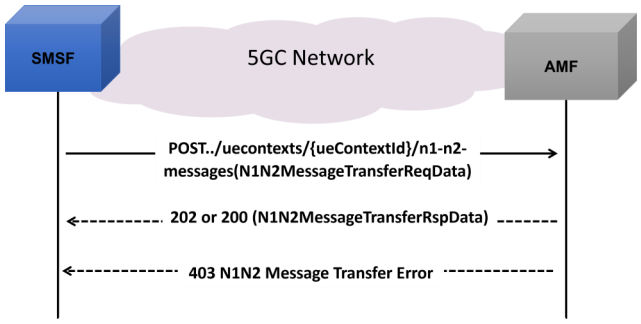


- AMF sends a POST request to the SMSF representing the UE's to activate SMS service for an user. The post request will contain SMS record to be sent
- On success, "200 OK " response SmsRecordDeliveryData is returned
- The SMSF will respond after successful inspection of the SMS payload, and set the "deliveryStatus" attribute to "SMS_DELIVERY_SMSF_ACCEPTED" and indicate the status of SMS record delivery attempt in the response body
- If the operation cannot be authorized due to e.g. UE does not have required subscription data, access barring or roaming restrictions, HTTP status code "403 Forbidden" should be returned

Namf_Communication Service

The SMSF uses N1N2 Message Transfer services to transfer N1 and/or N2 information to the UE through the AMF in the following procedures:

- Network triggered Service Request
- PDU Session establishment
- PDU Session modification
- PDU Session release
- Session continuity, service continuity and UP path management
- Inter NG-RAN node N2 based handover
- SMS over NAS procedures
- UE assisted and UE based positioning procedure
- Network assisted positioning procedure
- UE configuration update procedure for transparent UE policy delivery



- The SMSF sends a POST request to transfer N1 and N2 information which include a N1N2MessageTransfer Notification URI to AMF in the request message
- On Success 200 OK response is received. The AMF shall set the cause IE in the N1N2MessageTransferRspData as "N1_N2_TRANSFER_INITIATED"
- On failure, the appropriate HTTP status code indicating the error shall be returned and appropriate additional error information should be returned in the POST response body

Command Line Interface (CLI)

The MAPS™ 5G N20 (AMF) can be configured as a CLI server application that supports Protocol control and interface procedure execution via instructions executed by command-line clients, such as Python. These clients can execute various functions remotely, such as initiating the testbed setup, loading scripts, profiles, call origination, termination, and traffic control etc.

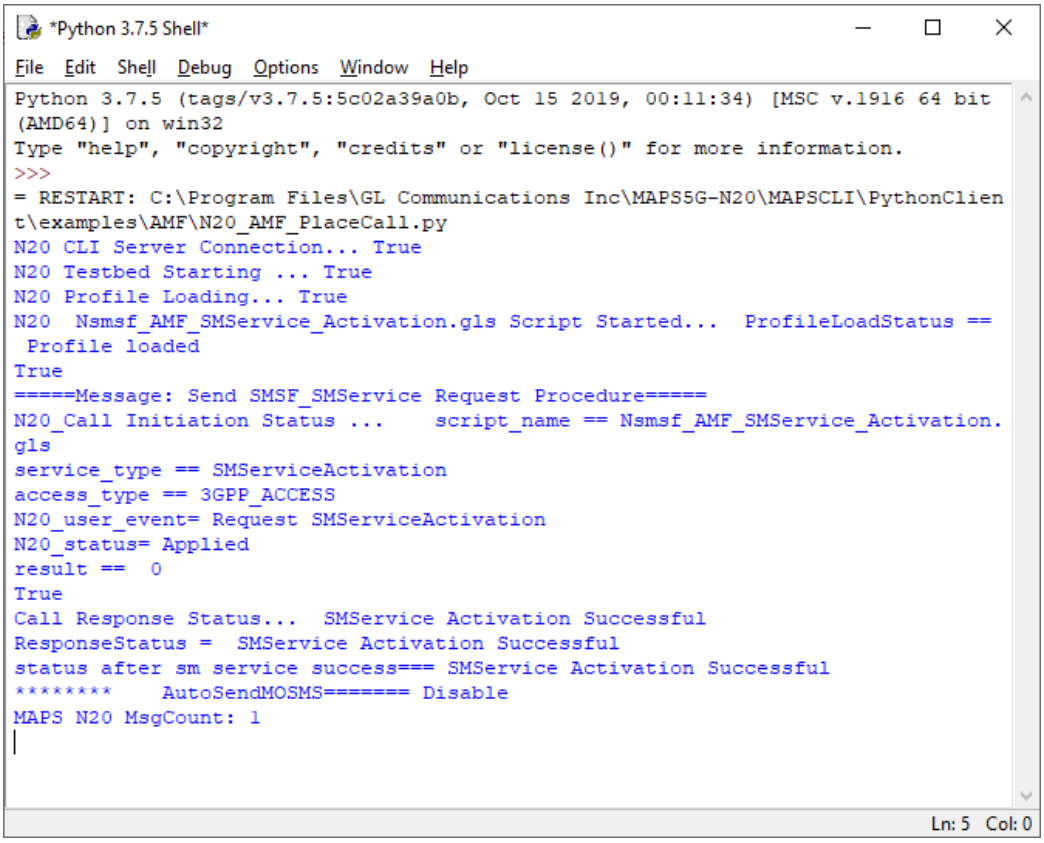


Figure: Sample Python Client

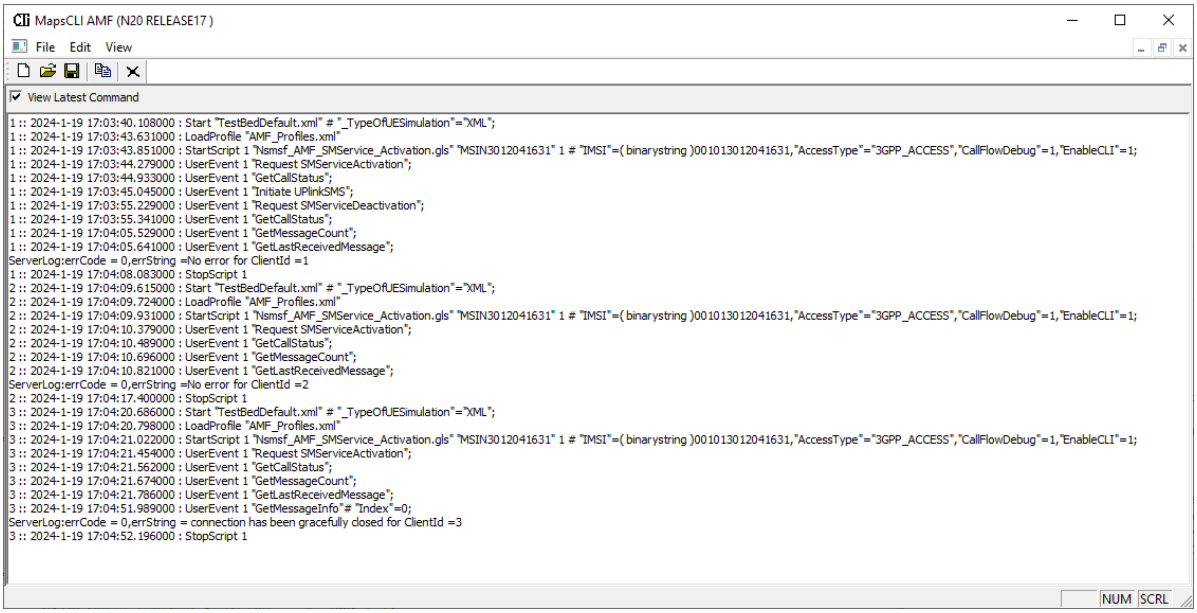
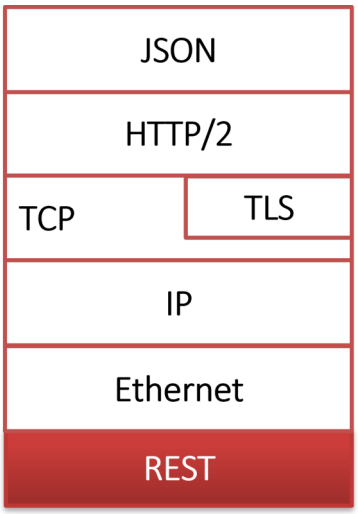


Figure: MAPS™ CLI Server

Supported Protocols and Specifications



Supported Protocol	Standard/ Specification
N20 Interface (SMSF - AMF)	TS29.540 (Release 17) TS29.518 (Release 17)
JavaScript Object Notation (JSON)	IETF RFC 8259
HTTP/2	IETF RFC 7231 IETF RFC 7540/RFC 7541
TLS	IETF RFC 8446
TCP	IETF RFC 793
IPv4	IETF RFC 791 [5] IETF RFC 2460 [6]

Buyer's Guide

Item No	Product Description
PKS508	MAPS™ 5G N20 Interface Emulator (Requires PKS502)
PKS305	MAPS™ 5G Multi-Interface Emulator

Item No	Related Software
PKS500	MAPS™ 5G N1/N2 Interface Emulator
PKS501	MAPS™ 5G N4 Interface Emulator
PKS502	5G Service based Emulation (Prerequisite base license for all service based (Open API) interface emulations)
PKS502	MAPS™ 5G N17 Interface Emulator
PKS503	MAPS™ 5G N8 Interface Emulator (Requires PKS502)
PKS504	MAPS™ 5G N10 Interface Emulator (Requires PKS502)
PKS505	MAPS™ 5G N11 Interface Emulator (Requires PKS502)
PKS506	MAPS™ 5G N12 Interface Emulator (Requires PKS502)
PKS507	MAPS™ 5G N13 Interface Emulator (Requires PKS502)
PKS509	MAPS™ 5G N21 Interface Emulator (Requires PKS502)
PKS510	MAPS™ 5G N22 Interface Emulator (Requires PKS502)
PKS511	MAPS™ 5G N29 Interface Emulator (Requires PKS502)
PKS511	MAPS™ 5G N51 Interface Emulator (Requires PKS502)
PKS170	CLI Support for MAPS™

For complete list of MAPS™ products, refer to Message Automation & Protocol Simulation (MAPS™) webpage.

For more details on supported MAPS™ 5G interfaces, refer to 5G Core (5GC) Network Test Solution webpage.

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