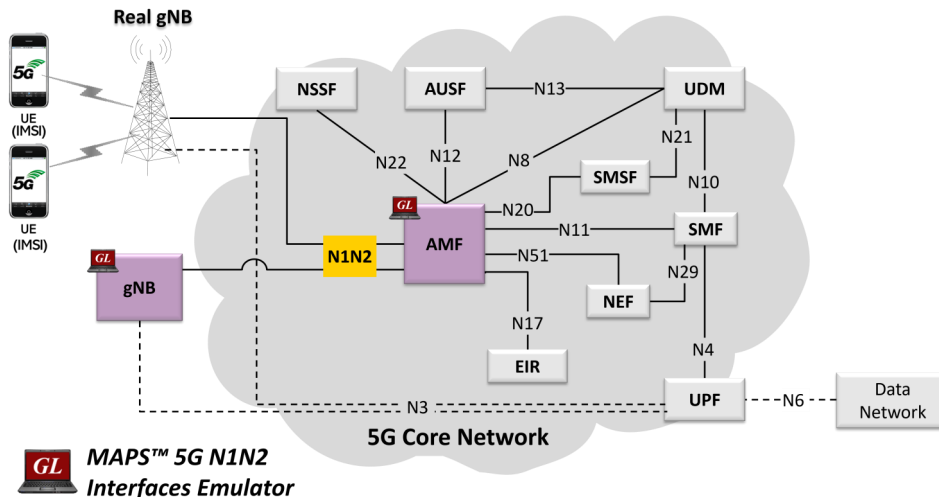


MAPS™ 5G N1N2 (NGAP) Emulator



Overview

GL's **Message Automation & Protocol Simulation (MAPS™)** is enhanced to test 5G N1N2 interface that can emulate gNodeB (gNB), and AMF (Access and Mobility Management Function) according to 3GPP standards.

It supports Non-Access-Stratum (NAS) signaling on N1N2 interface between UE and AMF. It also supports NGAP to emulate signaling services between NG-RAN and AMF.

MAPS™ N1N2 Interface emulator supported procedures include - NG Reset, NG Setup, Initial Context Setup, UE Context Release, Registration, De-registration, Primary authentication and key agreement procedure, Security mode control, Identification and PDU session management and SMS over NAS. The application gives the users an unlimited ability to edit NGAP/NAS message and call scenarios (message sequences).

In addition to control plane emulation the application supports generation and verification of traffic, including VoNR (Voice) calls with SIP signaling and RTP Traffic generation. It also emulates mobile traffic such as HTTP, FTP, Video by playing back real capture stateful over established TCP connection with additional licenses - Mobile Traffic Core – GTP (ETH101) and Mobile Traffic Core – Gateway (ETH102).

GL MAPS™ is not only used for protocol validation but also for performance and capacity by emulating tens of thousands of 5G subscribers.

MAPS™ 5G NGAP emulator supports utilities like Message Editor, Script Editor, and Profile Editor which allows new scenarios to be created or modified using 5G NGAP/N1N2 messages and parameters.

For more information, please refer to [MAPS™ 5G N1N2 Interface Emulator](#) webpage.

Main Features

- MAPS™ 5G N1N2 interface emulates gNodeB and AMF
- Application supports 5G Control Plane and User Plane
- Supported traffic types includes mobile data traffic such as HTTP and VoNR
- Generates and processes NGAP/NAS (valid and invalid) messages
- Includes gateway functionality to forward mobile traffic over GTP to and from external IP network
- Customization of call flow and message templates using Script and Message Editor
- Ready-to-use scripts for quick testing
- Supports scripted call generation and automated call reception
- Provides detailed Statistics and Events Status
- Emulates tens of thousands of 5G subscribers
- Automation, Remote access, and Schedulers to run tests 24/7



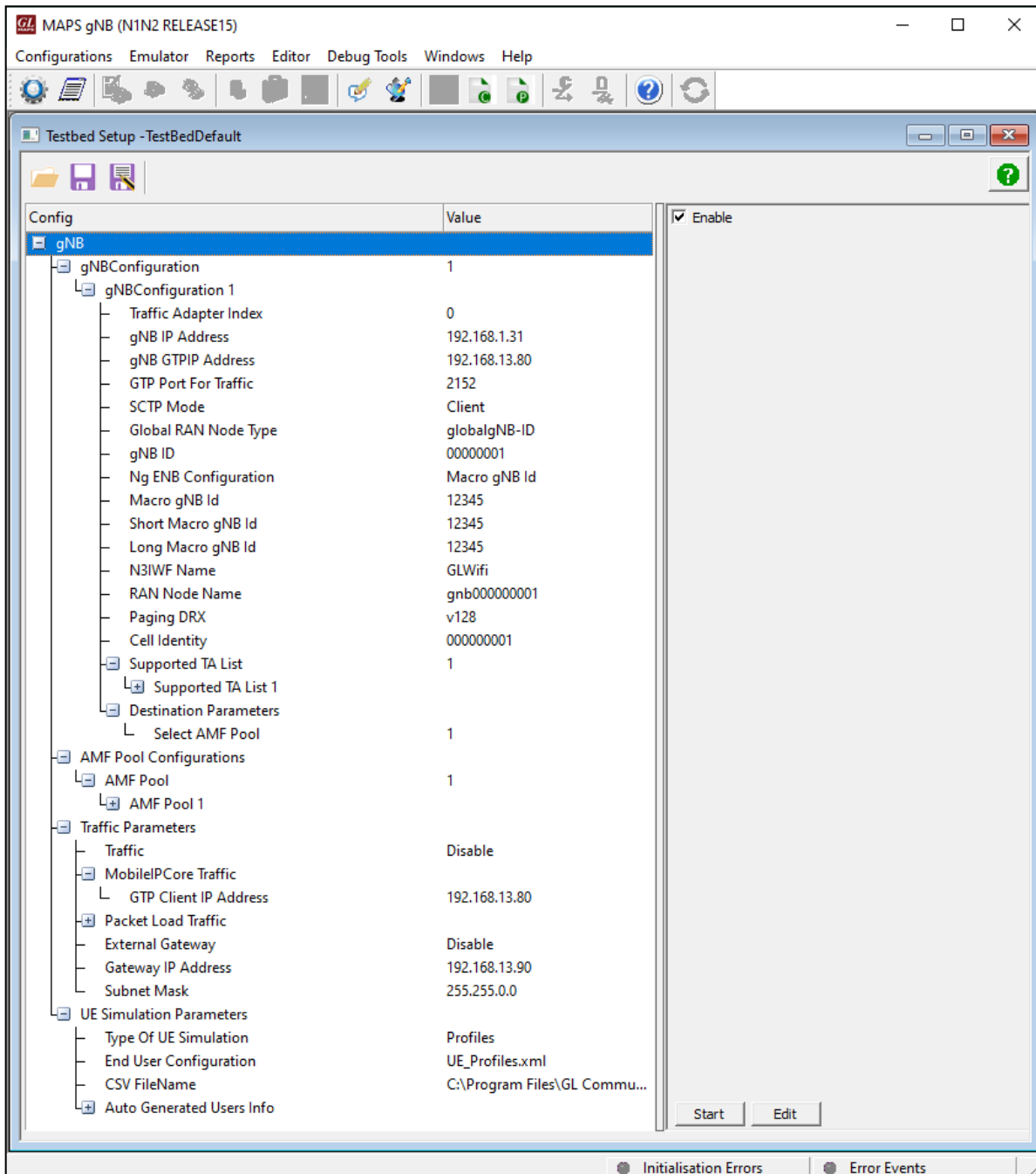
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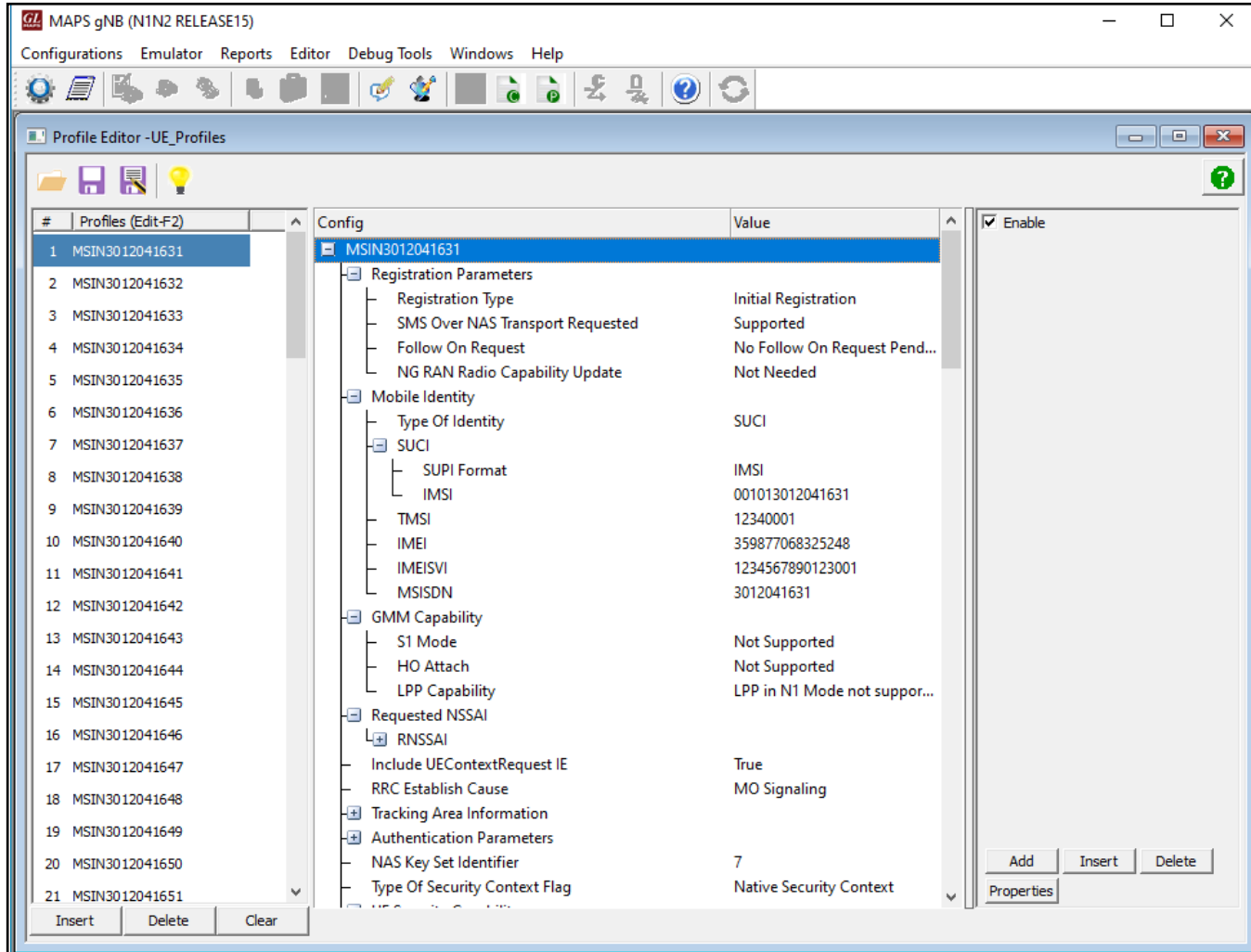
Testbed Configuration

The testbed setup window allows users to setup the required test environment with SCTP configuration in N1N2 interface. SCTP configuration parameters consist of Source/Destination IP addresses, and Port numbers to configure MAPS™ to emulate gNodeB and AMF entities in N1N2 interface. MAPS™ can then generate and receive NGAP/NAS messages to/from valid IP address in the 5G network. End user configuration profile is used to configure MAPS™ 5G N1N2 with supported gNodeB and AMF parameters.



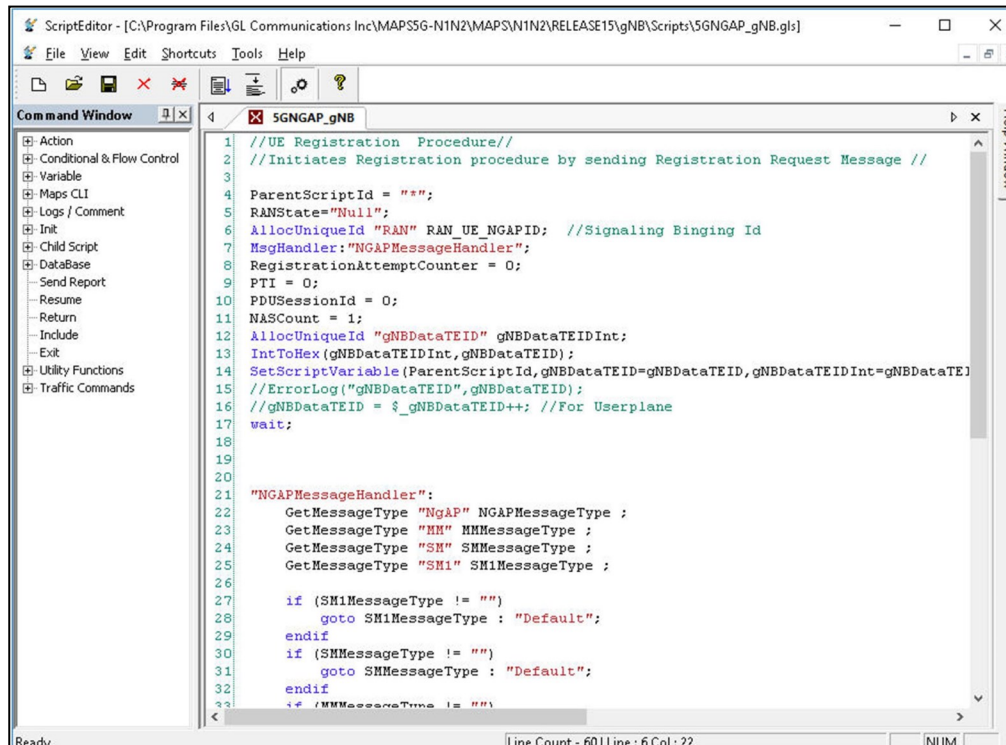
Pre-processing Tools

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. The UE_Profiles includes 5G parameters, that is required to configure multiple UEs to emulate Signaling, Traffic, VoLTE calls. User can configure Mobile Traffic parameters, allowing emulation of offline HTTP Traffic using Mobile IP Core TCP Client Server connections.

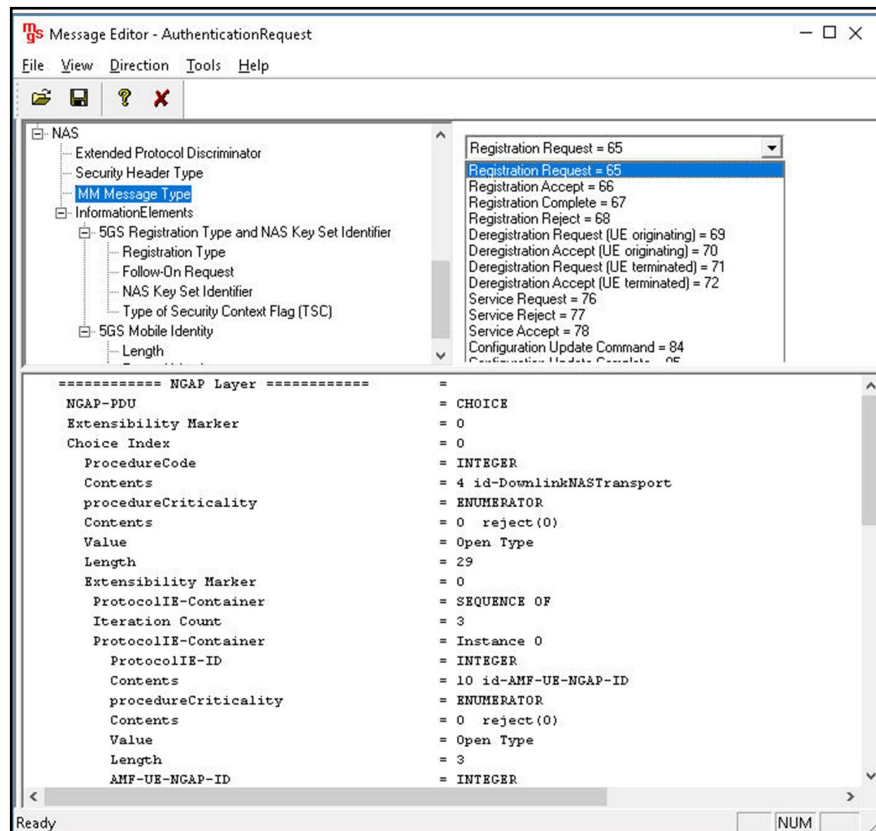


Pre-processing Tools (Contd.)

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.



MESSAGE EDITOR - The message editor allows user to build a template for each protocol message type. The value for each field may be changed in the message template prior to testing. The protocol fields comprise of mandatory and optional parameters.



Call Generation and Call 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). The test scripts are started manually at call generation, and at the call reception, the script is automatically triggered by incoming messages.

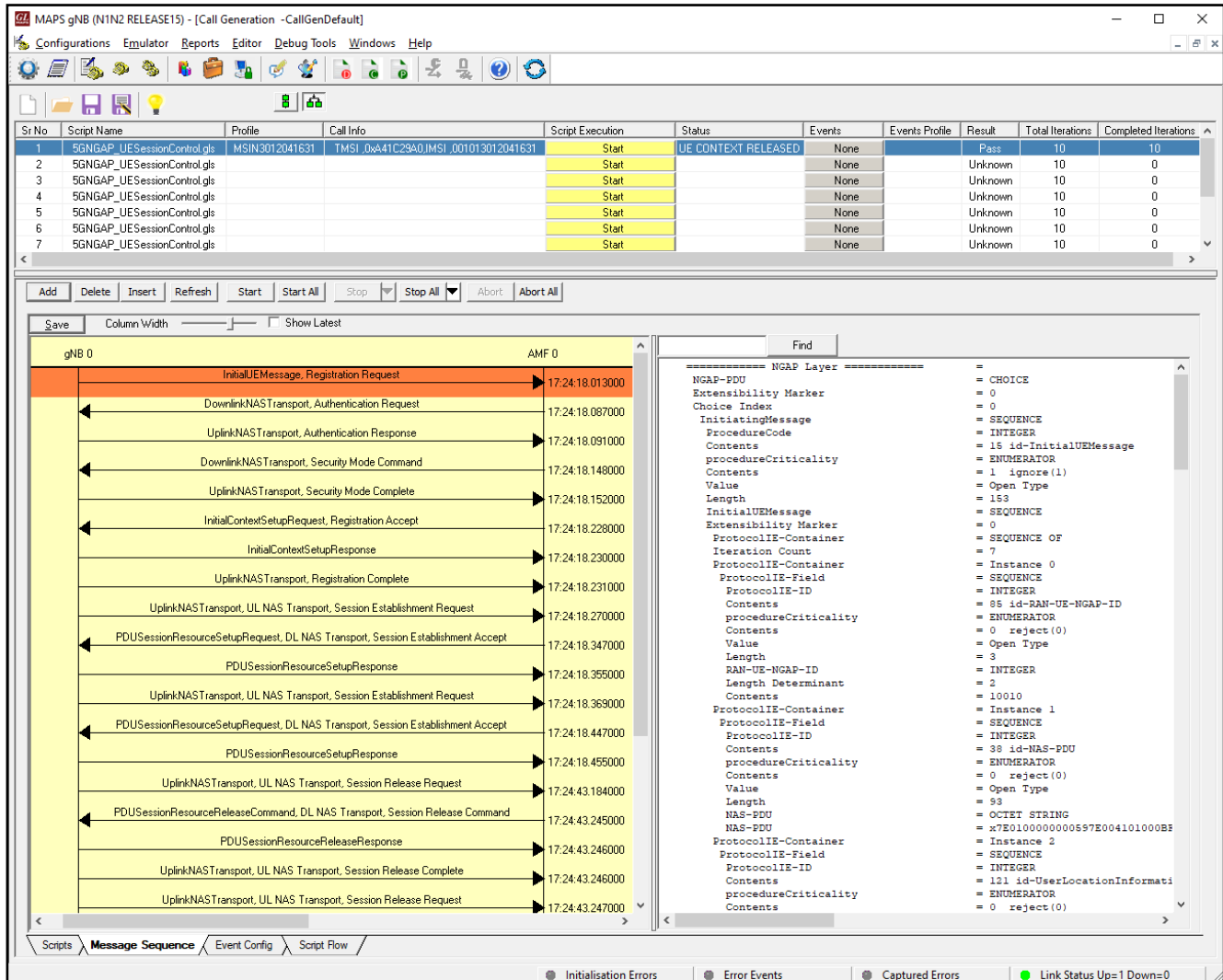


Figure: Call Reception

Call Generation and Call Reception (Contd.)

The screenshot displays the MAPS AMF (NIN2 RELEASE15) - [Call Reception] window. The interface includes a menu bar (Configurations, Emulator, Reports, Editor, Debug Tools, Windows, Help) and a toolbar. A table at the top shows the execution status of three scripts (9, 10, 11), all of which are completed with a 'Pass' result. Below this, a 'Message Sequence' tab is active, showing a timeline of messages between gNB 0 and AMF. The messages include InitialUEMessage, DownlinkNASTransport, UplinkNASTransport, and PDUSessionResourceSetupRequest/Response. To the right, a 'Find' panel displays the NGAP Layer details for the selected message, showing fields like Extensibility Marker, Choice Index, InitiatingMessage, and various IDs.

Sr No	Script Name	Profile	Call Info	Script Execution	Status	Events	Events Profile	Results
9	AMFSessionControl.gls		TMSI,0xA41C299E	Completed	UE-CONTEXT RELEASED	None		Pass
10	AMFSessionControl.gls		TMSI,0xA41C299F	Completed	UE-CONTEXT RELEASED	None		Pass
11	AMFSessionControl.gls		TMSI,0xA41C29A0	Completed	UE-CONTEXT RELEASED	None		Pass

gNB 0 AMF

InitialUEMessage, Registration Request 17:24:18.056000

DownlinkNASTransport, Authentication Request 17:24:18.067000

UplinkNASTransport, Authentication Response 17:24:18.130000

DownlinkNASTransport, Security Mode Command 17:24:18.133000

UplinkNASTransport, Security Mode Complete 17:24:18.190000

InitialContextSetupRequest, Registration Accept 17:24:18.195000

InitialContextSetupResponse 17:24:18.271000

UplinkNASTransport, Registration Complete 17:24:18.273000

UplinkNASTransport, UL NAS Transport, Session Establishment Request 17:24:18.312000

PDUSessionResourceSetupRequest, DL NAS Transport, Session Establishment Accept 17:24:18.321000

PDUSessionResourceSetupResponse 17:24:18.411000

UplinkNASTransport, UL NAS Transport, Session Establishment Request 17:24:18.414000

PDUSessionResourceSetupRequest, DL NAS Transport, Session Establishment Accept 17:24:18.423000

PDUSessionResourceSetupResponse 17:24:18.490000

UplinkNASTransport, UL NAS Transport, Session Release Request 17:24:43.227000

PDUSessionResourceReleaseCommand, DL NAS Transport, Session Release Command 17:24:43.228000

PDUSessionResourceReleaseResponse 17:24:43.288000

UplinkNASTransport, UL NAS Transport, Session Release Complete 17:24:43.288000

UplinkNASTransport, UL NAS Transport, Session Release Request 17:24:43.289000

PDUSessionResourceReleaseCommand, DL NAS Transport, Session Release Command 17:24:43.289000

PDUSessionResourceReleaseResponse 17:24:43.347000

UplinkNASTransport, UL NAS Transport, Session Release Complete 17:24:43.347000

UplinkNASTransport, Deregistration Request

Find

NGAP Layer

NGAP-PDU = CHOICE

Extensibility Marker = 0

Choice Index = 0

InitiatingMessage = SEQUENCE

ProcedureCode = INTEGER

Contents = 15 id-InitialUEMessage

procedureCriticality = ENUMERATOR

Contents = 1 ignore(1)

Value = Open Type

Length = 153

InitialUEMessage = SEQUENCE

Extensibility Marker = 0

ProtocolIE-Container = SEQUENCE OF

Iteration Count = 7

ProtocolIE-Container = Instance 0

ProtocolIE-Field = SEQUENCE

ProtocolIE-ID = INTEGER

Contents = 95 id-RAN-UE-NGAP-ID

procedureCriticality = ENUMERATOR

Contents = 0 reject(0)

Value = Open Type

Length = 3

RAN-UE-NGAP-ID = INTEGER

Length Determinant = 2

Contents = 10010

ProtocolIE-Container = Instance 1

ProtocolIE-Field = SEQUENCE

ProtocolIE-ID = INTEGER

Contents = 38 id-NAS-PDU

procedureCriticality = ENUMERATOR

Contents = 0 reject(0)

Value = Open Type

Length = 93

NAS-PDU = OCTET STRING

NAS-PDU = x7E0161E21CEC597E004101000BF200

ProtocolIE-Container = Instance 2

ProtocolIE-Field = SEQUENCE

ProtocolIE-ID = INTEGER

Contents = 121 id-UserLocationInformation

procedureCriticality = ENUMERATOR

Contents = 0 reject(0)

Value = Open Type

Length = 15

UserLocationInformation = CHOICE

Choice Index = 1

userLocationInformationNR = SEQUENCE

Extensibility Marker = 0

Preamble = 00

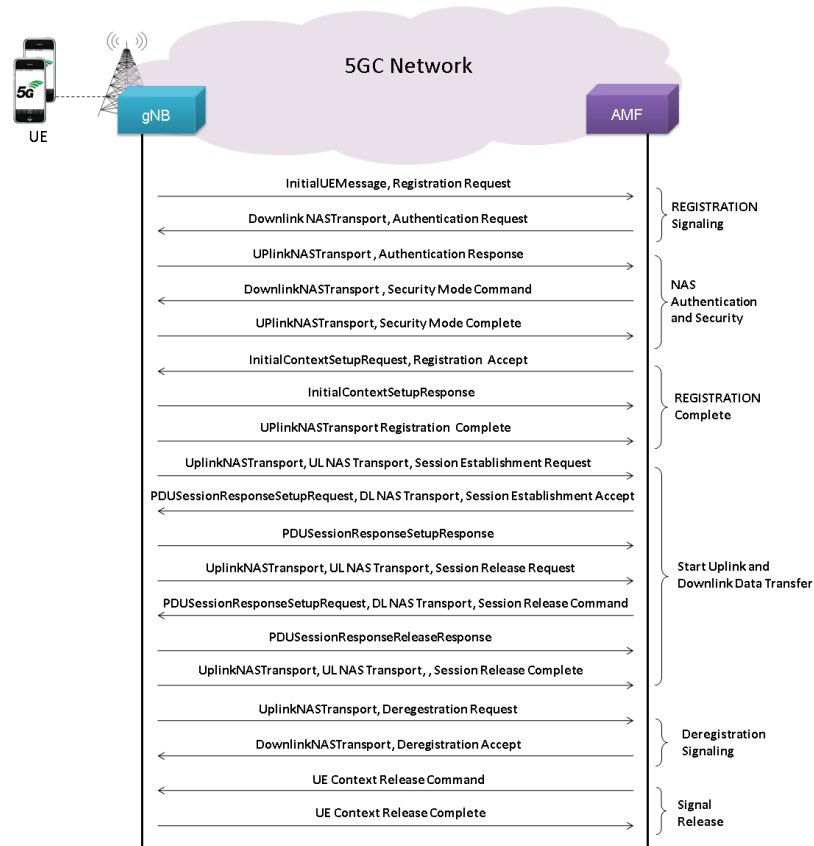
nR-CGI = SEQUENCE

Initialisation Errors Error Events Captured Errors Link Status Up=1 Down=0

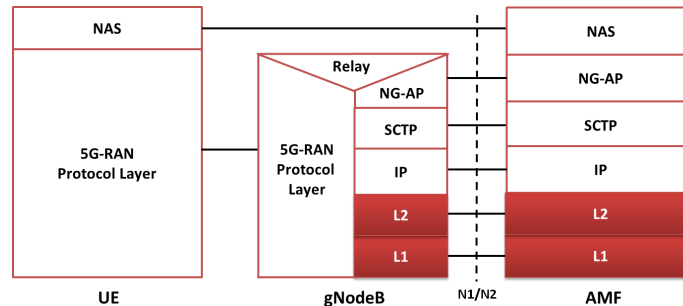
Figure: Call Reception

Emulation of 5G N1N2 Signaling Procedure

The below 5G N1N2 signaling procedure indicates the messages flow between gNodeB (gNB) and AMF, which are emulated using MAPS™ application.



Supported Protocols and Specifications



Supported Protocols	Standard / Specification
N1N2 Interface (gNB - AMF)	TS24.501
System Architecture for the 5G	3GPP TS 23.501
Non-Access-Stratum (NAS)	3GPP TS 24.501
NG Application Protocol (NGAP)	3GPP TS 38.413
SCTP	RFC 4960
GPRS Tunneling Protocol for User Plane (GTP-U)	3GPP TS 29.281

Buyer's Guide

Item No	Product Description
PKS500	MAPS™ 5G N1N2 Interface Emulator
ETH101	Mobile Traffic Core - GTP
ETH102	Mobile Traffic Core - Gateway

Item No	Related Software
PKS305	MAPS™ 5G Multi-Interface Emulation
PKS501	MAPS™ 5G N4 Interface Emulator
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)
PKS508	MAPS™ 5G N20 Interface Emulator (Requires PKS502)
PKS509	MAPS™ 5G N21 Interface Emulator (Requires PKS502)
PKS510	MAPS™ 5G N22 Interface Emulator (Requires PKS502)
PKS511	MAPS™ 5G N29 and N51 Interface Emulator (Requires PKS502)

For complete list of MAPS™ products, please 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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