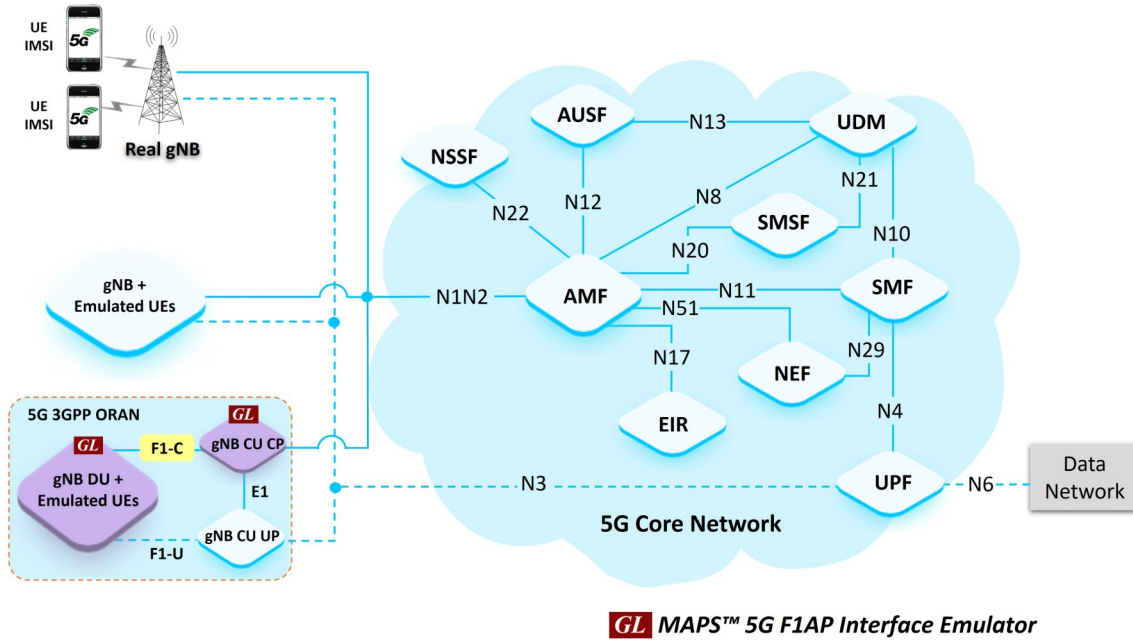


# MAPS™ 5G ORAN F1 Interface Emulator



## Overview

GL's **Message Automation & Protocol Simulation (MAPS™)** tests the **5G ORAN F1AP** interface, emulating both **gNB Central Unit (CU)** and **gNB Distributed Unit (DU)** in compliance with 3GPP TS 38.473 specification. The F1 interface connects CU and DU through F1-C (Control Plane) and F1-U (User Plane), enabling functional split and efficient midhaul communication in 5G ORAN architecture.

The MAPS™ F1AP Interface Emulator supports key 5G midhaul procedures such as UE Context Setup, Bearer Management, and RRC Message Forwarding, ensuring reliable and standards-compliant operation. Users can emulate either gNB CU or gNB DU network elements to test real-world signaling scenarios across both planes.

In addition to control-plane signaling, the application supports user-plane packet emulation using GL's **Mobile Traffic Core – GTP (ETH101)** and **Mobile Traffic Core – Gateway (ETH102)** licenses. This enables end-to-end midhaul traffic generation, verification, and performance analysis between CU and DU.

MAPS™ 5G ORAN F1AP is a versatile tool for functional testing, regression testing, load testing, and fault insertion, allowing engineers to validate performance, interoperability, and QoS handling without requiring live RAN equipment. The platform includes powerful utilities such as Message Editor, Script Editor, and Profile Editor, enabling users to customize signaling procedures, simulate configurations, and verify 5G ORAN midhaul operations.

For more information, visit [MAPS™ 5G ORAN F1 Interface Emulator](#) webpage.

## Main Features

- MAPS™ 5G ORAN F1AP interface emulates gNB Central Unit (CU) and Distributed Unit (DU)
- Supports 5G F1-C (Control Plane) and F1-U (User Plane) procedures
- Generates and processes valid and invalid F1AP messages for protocol compliance testing
- Supports GTP-U traffic tunneling for end-to-end user-plane emulation
- Provides fault insertion and impairment simulation for robustness and negative testing
- Ready-to-use scripts for quick and repeatable F1 interface testing
- Customizable call flow and message templates using Script, Message, and Profile Editors
- Supports automated call generation, reception, and scheduling for 24/7 remote testing
- Performs performance, load, functional, and regression testing of CU and DU nodes
- Supports SCTP over IP transport layer testing with configurable association parameters
- Simulates large-scale midhaul environments for interoperability, training, and R&D testing



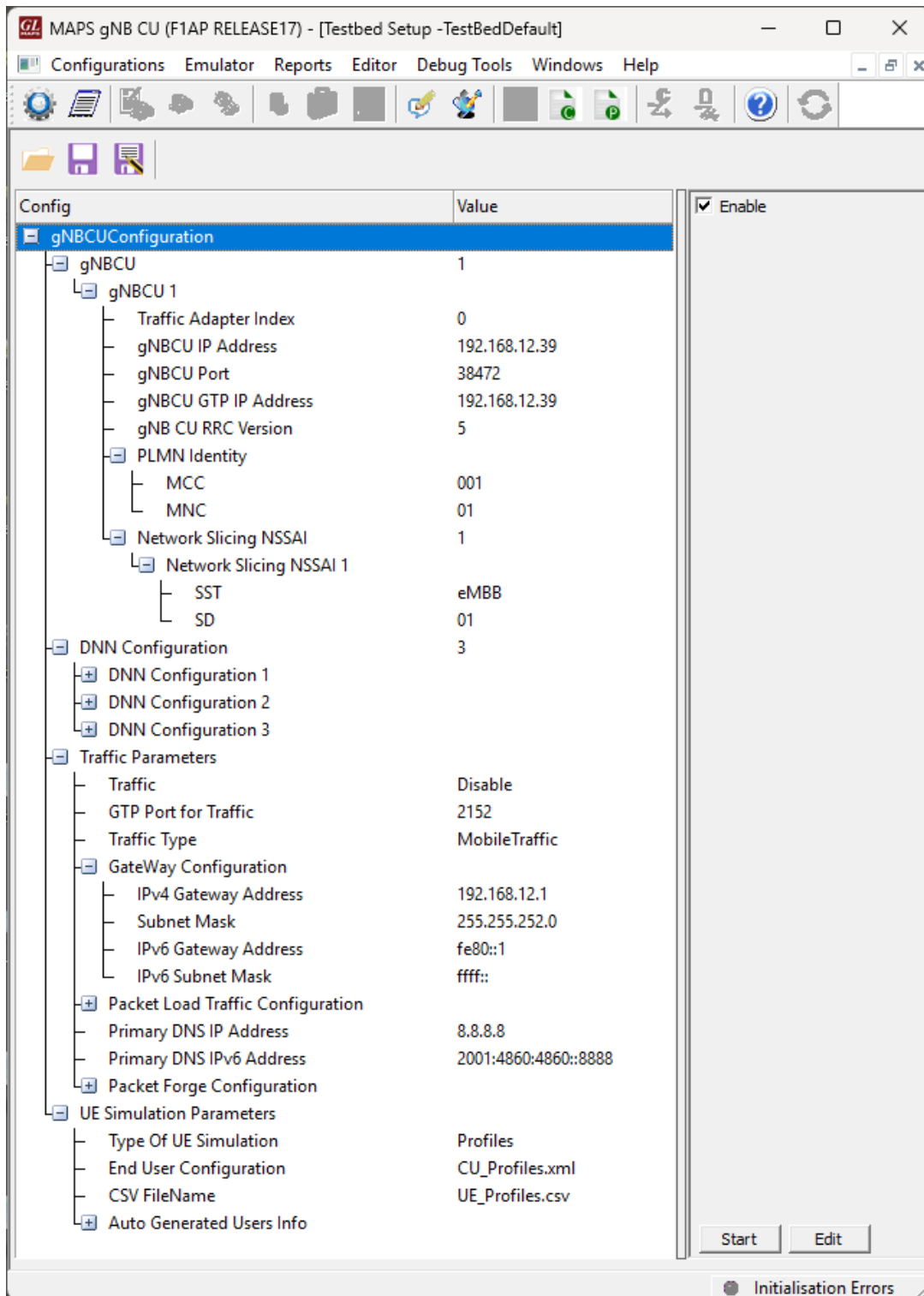
**GL Communications Inc.**

818 West Diamond Avenue - Third Floor, Gaithersburg, MD 20878, U.S.A

(Web) [www.gl.com](http://www.gl.com) - (V) +1-301-670-4784 (F) +1-301-670-9187 - (E-Mail) [info@gl.com](mailto:info@gl.com)

## Testbed Configuration

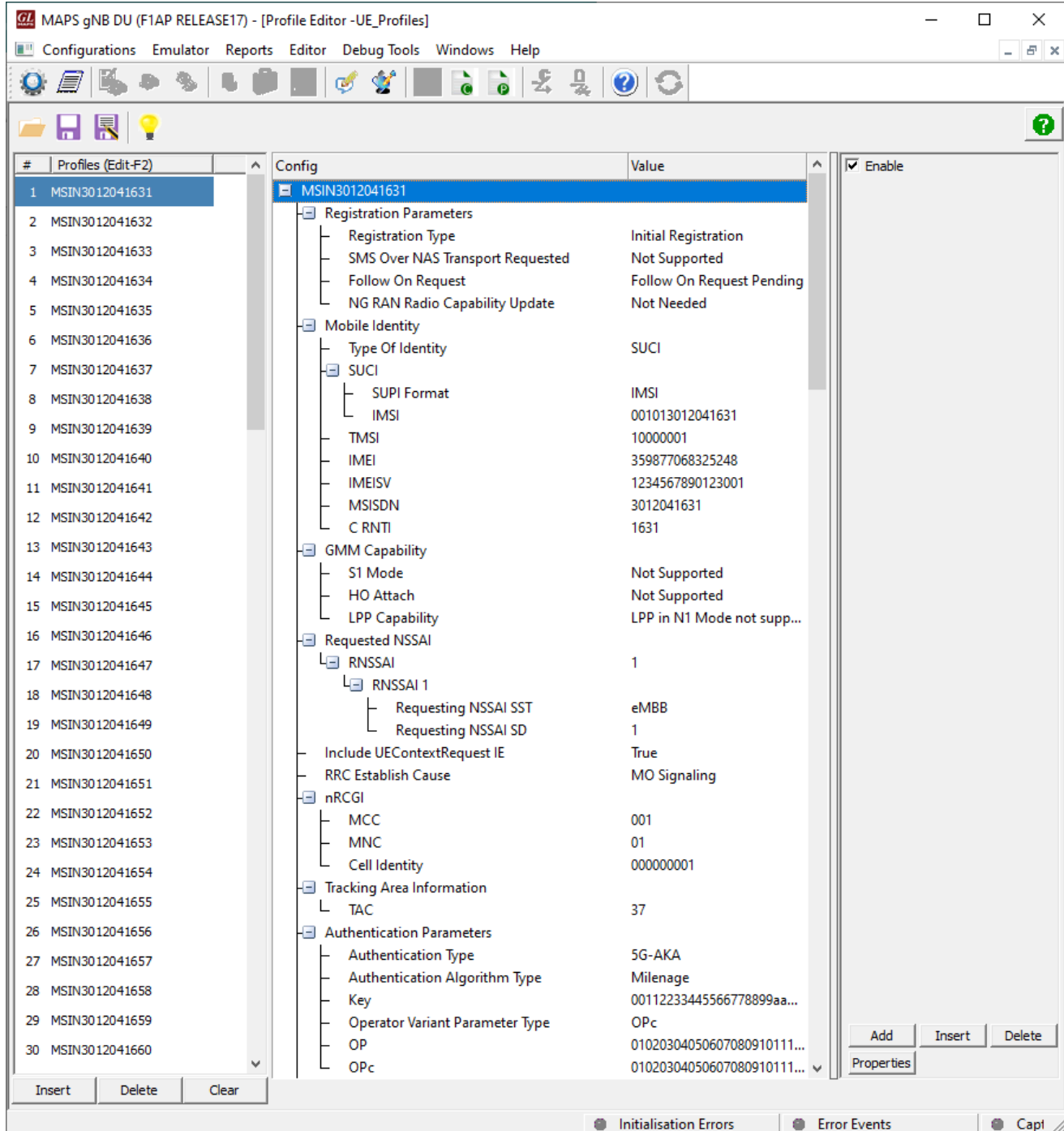
The testbed setup window allow users to setup the required test configurations in F1 interface. It includes a list of variables that are declared and assigned before starting the script. Testbed Setup defines the MAPS™ parameters which communicates with the rest of the test network. End user configuration profile is used to configure MAPS™ 5G F1AP interface with the supported gNB DU and gNB CU parameters.



Testbed Setup

## 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 allow user to configure call instances in call generation to receive calls. The **UE\_Profiles** include 5G parameters, that is required to configure multiple UEs to emulate Signaling and Traffic.



Profile Editor

## Pre-processing Tools (Contd.)

**SCRIPT EDITOR** - The script editor allow 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.

```

ScriptEditor - [C:\Program Files\GL Communications Inc\MAPS5G-F1AP\MAPS\F1AP\RELEASE17\gNB-DU\Scripts\F1APManagementHandler.gls]
File View Edit Shortcuts Tools Help

F1APManagementHandler

1 //***** Initialization *****/
2
3 FlAP_CONNECTION="Unsuccessful";
4 Result="Fail";
5 _gNBDUTransactionId = 1;
6
7 MsgHandler:"5GMessageHandler";
8 Status = "SCTP status UP";
9 MgmtScriptId = "FlAP-Mgmt";
10 StartChildScript (MgmtScriptId,"FlAP","FlAPMgmt.gls","",ConnectionID=ConnectionID,gnbid=gnbid);
11 starttimer InitTimer 100 msec;
12 wait;
13
14 "InitTimerExpiry":
15 //below linefor testing only to be removed
16 ConnectionID=_DefaultConnectionID;
17 goto "SendFlSetupRequest";
18 resume;
19
20 //***** Protocol State Machine Starts *****/
21
22 "SendFlSetupRequest":
23   gNBDUTransactionId = _gNBDUTransactionId;
24   (MgmtScriptId) goto "SendFlSetupRequest":gNBDUTransactionId,ConnectionID,RecvSrcPort,RecvDstPort;
25   resume;
26
27 "OnFlSetupResponse":
28   Status = "FlAP-LINK-UP";
29   Result = "Pass";
30   EventLog (Status);
31   FlAP_CONNECTION="Successful";
32   KIdDispStr1="gNBDUID:";
33   AppendInAscii (KIdDispStr1,gNBDUID);
34   KIdDispStr2=" ConnectionId:";
35   AppendInAscii (KIdDispStr2,ConnectionID);

```

Ready | Line Count - 90 | Line: 1 Col: 1

Script 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, allow 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.

The screenshot displays the MAPS gNB DU (F1AP RELEASE17) - [Call Generation - CallGenDefault] interface. The top menu bar includes Configurations, Emulator, Reports, Editor, Debug Tools, Windows, and Help. Below the menu is a toolbar with various icons. The main window is divided into several sections:

- Script Execution Table:** A table with columns: Sr..., Script Name, Profile, Call Info, Script Execution, Status, Events, Events..., Result, Total Iterations, and Completed Iterations. It lists four scripts, all with a status of 'Start' and 'RM-DEREGISTERED'.
- Message Sequence Diagram:** A diagram showing the sequence of messages between gNB-DU-0 and gNBCU. The messages include InitialULRRCTransfer, RRCSetupRequest, DLRRCTransfer, RRCSetup, ULRRCTransfer, RRCSetupComplete, Registration Request, DLRRCTransfer, DLInformationTransfer, Authentication Request, ULRRCTransfer, ULInformationTransfer, Authentication Response, DLRRCTransfer, DLInformationTransfer, Security Mode Command, ULRRCTransfer, ULInformationTransfer, Security Mode Complete, DLRRCTransfer, SecurityModeCommand, ULRRCTransfer, SecurityModeComplete, DLRRCTransfer, DLInformationTransfer, Registration Accept, ULRRCTransfer, ULInformationTransfer, Registration Complete, ULRRCTransfer, ULInformationTransfer, UL NAS Transport, Session Establishment Request, UEContextSetupRequest, UEContextSetupResponse, DLRRCTransfer, DLInformationTransfer, DL NAS Transport, Session Establishment Accept, ULRRCTransfer, ULInformationTransfer, UL NAS Transport, Session Release Request, UEContextModificationRequest, UEContextModificationResponse, DLRRCTransfer, DLInformationTransfer, DL NAS Transport, Session Release Command, ULRRCTransfer, ULInformationTransfer, UL NAS Transport, Session Release Complete, ULRRCTransfer, ULInformationTransfer, Deregistration Request, UEContextReleaseCommand, RRCRelease, and UEContextReleaseComplete.
- F1AP Layer Details:** A detailed view of the F1AP layer messages, showing the structure and values of various fields. The messages are categorized into F1AP-PDU, Choice Index, InitiatingMessage, ProcedureCode, Contents, Criticality, Length, Value, Extensibility Marker, ProtocolIE-Container, Iteration Count, ProtocolIE-Field, and ProtocolIE-ID.

The bottom status bar shows 'Initialisation Errors', 'Error Events', 'Captured Errors', and 'Link Status Up=1 Down=0'.

### Call Generation

## Call Generation and Call Reception (Contd.)

MAPS gNB CU (F1AP RELEASE17) - [Call Reception]

Configurations Emulator Reports Editor Debug Tools Windows Help

Sr No	Script Name	Profile	Call Info	Script Execution	Status	Events	Results
1	F1APManagementHandler.gls		gNBduId:100, gNBduTransactionId:1, ConnectionId:1002	Stop	F1 Setup Successful	SendF1Reset	Pass
2	gNBCUSessionControl.gls		MSIN: 3012041631	Completed	DE-REGISTRATION ACCEPTED	None	Pass

Stop Stop All Abort Abort All ☒ Show Records ☐ Select Active Call ☐ Auto Trash Trash

Save Column Width ☐ Show Latest

gNB-DU

gNB-CU-0

InitialULRRMessageTransfer, RRCSetupRequest → 11:30:05.309000

← DLRRMessageTransfer, RRCSetup 11:30:05.314000

ULRRMessageTransfer, RRCSetupComplete, Registration Request → 11:30:05.506000

← DLRRMessageTransfer, DLInformationTransfer, Authentication Request 11:30:05.510000

ULRRMessageTransfer, ULInformationTransfer, Authentication Response → 11:30:05.707000

← DLRRMessageTransfer, DLInformationTransfer, Security Mode Command 11:30:05.709000

ULRRMessageTransfer, ULInformationTransfer, Security Mode Complete → 11:30:05.907000

← DLRRMessageTransfer, SecurityModeCommand 11:30:05.910000

ULRRMessageTransfer, SecurityModeComplete → 11:30:06.108000

← DLRRMessageTransfer, DLInformationTransfer, Registration Accept 11:30:06.110000

ULRRMessageTransfer, ULInformationTransfer, Registration Complete → 11:30:06.310000

ULRRMessageTransfer, ULInformationTransfer, UL NAS Transport, Session Establishment Request → 11:30:06.311000

← UEContextSetupRequest 11:30:06.314000

UEContextSetupResponse → 11:30:06.508000

← DLRRMessageTransfer, DLInformationTransfer, DL NAS Transport, Session Establishment Accept 11:30:06.510000

ULRRMessageTransfer, ULInformationTransfer, UL NAS Transport, Session Release Request → 11:30:13.845000

← UEContextModificationRequest 11:30:13.847000

UEContextModificationResponse → 11:30:14.045000

← DLRRMessageTransfer, DLInformationTransfer, DL NAS Transport, Session Release Command 11:30:14.047000

ULRRMessageTransfer, ULInformationTransfer, UL NAS Transport, Session Release Complete → 11:30:14.246000

ULRRMessageTransfer, ULInformationTransfer, Deregistration Request → 11:30:14.247000

← UEContextReleaseCommand, RRCRelease 11:30:14.250000

UEContextReleaseComplete → 11:30:14.445000

Find

===== F1AP Layer =====

```

0000 F1AP-PDU = CHOICE
0000 Choice Index = 0
0000 InitiatingMessage = SEQUENCE
0001 ProcedureCode = INTEGER
0001 Contents = 11 id-InitialULRRM
0002 Criticality = ENUMERATOR
0002 Contents = 1 ignore(1)
0003 Length = 425
0005 Value = Open Type
0005 InitialULRRMessageTransferIEs = SEQUENCE
0005 Extensibility Marker = 0
0005 ProtocolIE-Container = SEQUENCE OF
0006 Iteration Count = 5
0008 ProtocolIE-Container = Item 0
0008 ProtocolIE-Field = SEQUENCE
0008 ProtocolIE-ID = INTEGER
0008 Contents = 41 id-gNB-DU-UE-F1A
000A Criticality = ENUMERATOR
000A Contents = 0 reject(0)
000B Length = 2
000C Value = Open Type
000C gNB-DU-UE-F1AP-ID = INTEGER
000C Length Determinant = 1
000D Contents = 2
000E ProtocolIE-Container = Item 1
000E ProtocolIE-Field = SEQUENCE
000E ProtocolIE-ID = INTEGER
000E Contents = 111 id-NRCGI
0010 Criticality = ENUMERATOR
0010 Contents = 0 reject(0)
0011 Length = 9
0012 Value = Open Type
0012 NRCGI = SEQUENCE
0012 Extensibility Marker = 0
0012 Preamble = 0
0013 pLMI-Identity = OCTET STRING
0013 MCC = 001
0014 MNC = 01
0016 nRCellIdentity = BITSTRING
0000 nRCellIdentity = ....0000 00000000 00
001B ProtocolIE-Container = Item 2
001B ProtocolIE-Field = SEQUENCE
001B ProtocolIE-ID = INTEGER
001B Contents = 95 id-C-RNTI
001D Criticality = ENUMERATOR
001D Contents = 0 reject(0)
001E Length = 3
001F Value = Open Type
001F C-RNTI = INTEGER
001F Extensibility Marker = 0
00?? Contents = 50 id-RRContainer

```

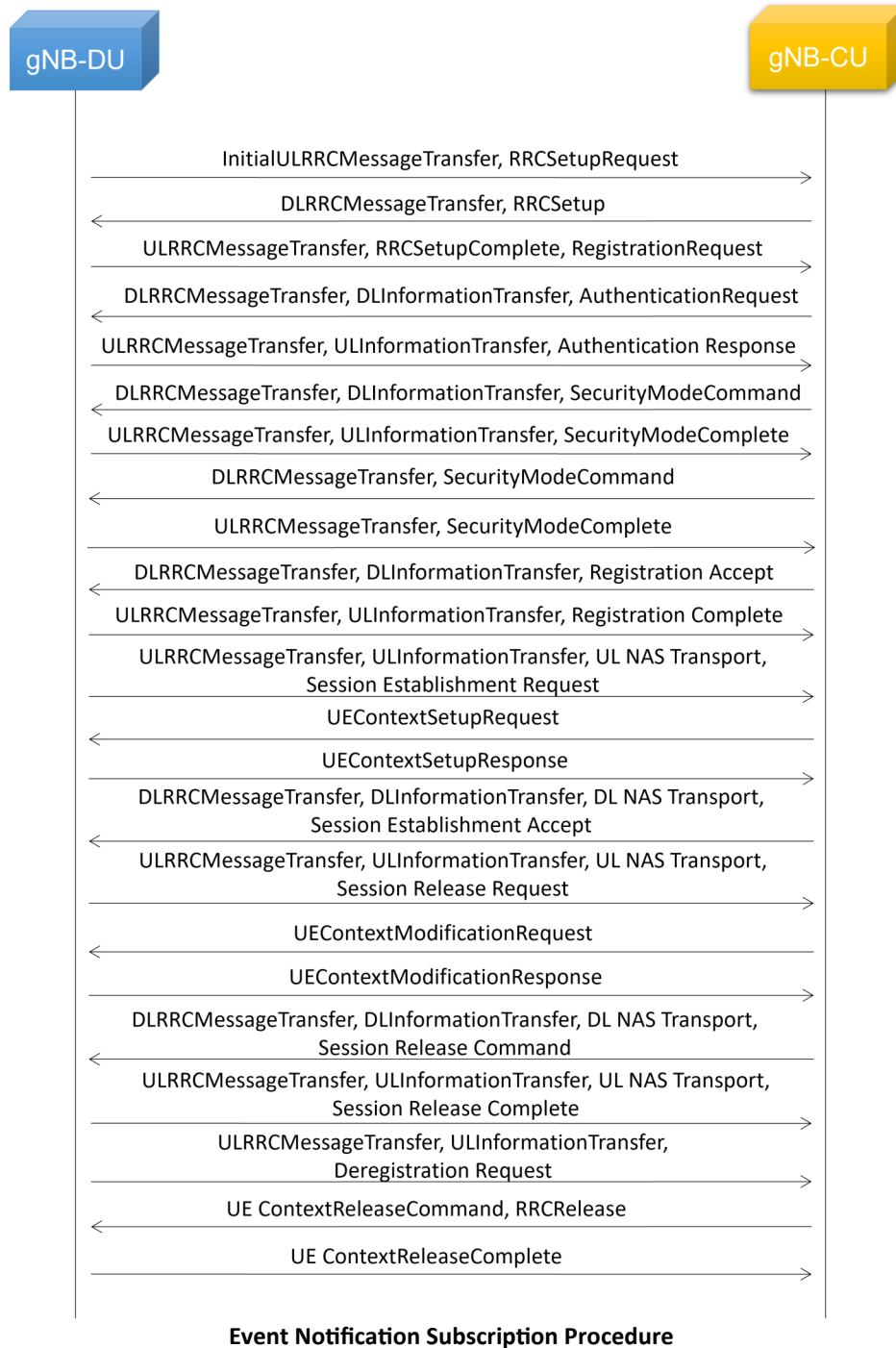
Scripts Message Sequence Event Config Script Flow

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

### Call Reception

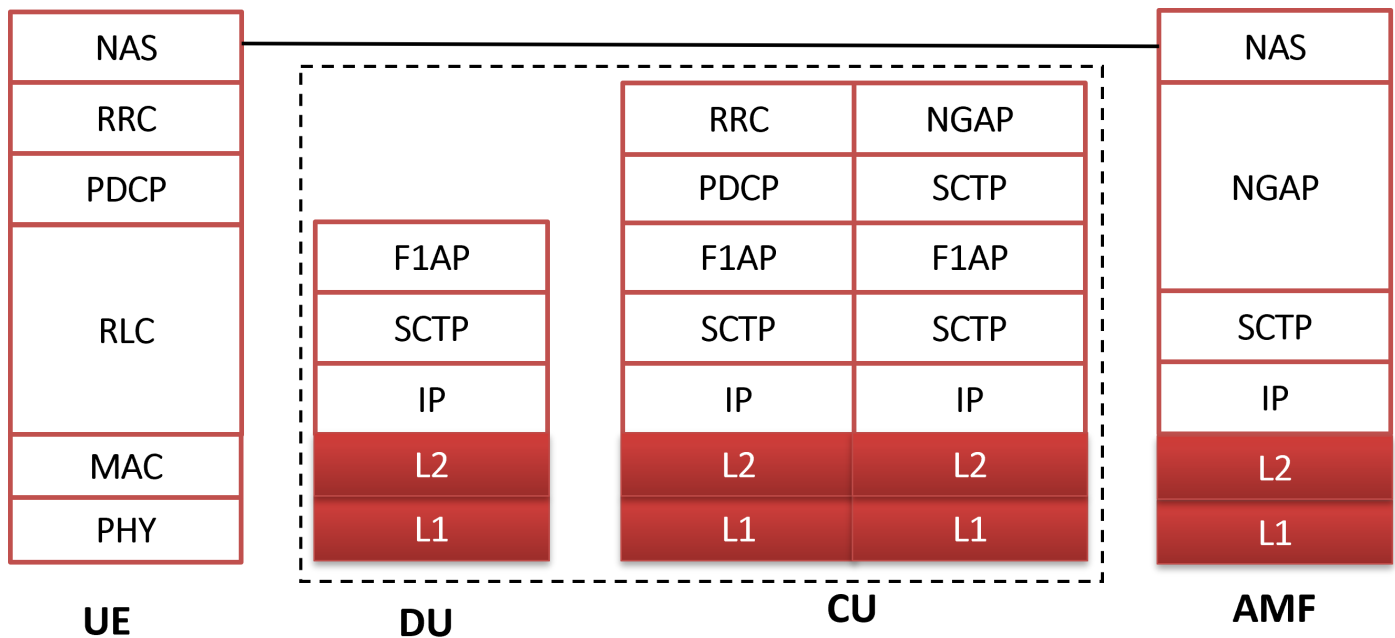
## Emulation of 5G F1AP Signaling Procedure

The below 5G F1AP signaling procedure indicates the messages flow between gNB DU and gNB CU , which are emulated using MAPS™ application.





## Supported Protocols and Specifications



Supported Protocols	Standard / Specifications
F1 Interface (gNB-CU – gNB-DU)	TS38.473
SCTP	RFC 4960
Non-Access-Stratum (NAS)	3GPP TS 24.501
NR and NG-RAN	3GPP TS 38.300 V17



## Buyer's Guide

Item No	Product Description
<a href="#">PKS512</a>	MAPS™ 5G-F1AP Interface Emulator
<a href="#">PKS513</a>	MAPS™ 5G-E1AP Interface Emulator

Item No	Related Software
<a href="#">PKS500</a>	MAPS™ 5G N1/N2 Interface Emulator
<a href="#">PKS501</a>	MAPS™ 5G N4 Interface Emulator
<a href="#">PKS502</a>	5G service-based Emulation (Prerequisite base license for all service-based (Open API) interface emulations)
<a href="#">PKS503</a>	MAPS™ 5G N8 Interface Emulator (Requires PKS502)
<a href="#">PKS504</a>	MAPS™ 5G N10 Interface Emulator (Requires PKS502)
<a href="#">PKS505</a>	MAPS™ 5G N11 Interface Emulator (Requires PKS502)
<a href="#">PKS506</a>	MAPS™ 5G N12 Interface Emulator (Requires PKS502)
<a href="#">PKS507</a>	MAPS™ 5G N13 Interface Emulation (Requires PKS502)
<a href="#">PKS502</a>	MAPS™ 5G N17 Interface Emulator
<a href="#">PKS508</a>	MAPS™ 5G N20 Interface Emulator (Requires PKS502)
<a href="#">PKS509</a>	MAPS™ 5G N21 Interface Emulator (Requires PKS502)
<a href="#">PKS510</a>	MAPS™ 5G N22 Interface Emulator (Requires PKS502)
<a href="#">PKS511</a>	MAPS™ 5G N29 Interface Emulator (Requires PKS502)
<a href="#">PKS511</a>	MAPS™ 5G N51 Interface Emulator (Requires PKS502)
<a href="#">PKS305</a>	MAPS™ 5G Multi-Interface Emulation
<a href="#">PKS170</a>	CLI Support for MAPS™

**Note:** PCs which include GL hardware/software require Intel or AMD processors for compliance.

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.