

5G Standalone Access Registration Signaling Messages

This document details messages involved in the 5G standalone access registration procedure. These messages are referenced from the [5G Standalone Access Registration Sequence Diagrams](#).

Message	Path
Preamble	UE → gNB
PDCCH DCI Format 1_0 └Format 1_0 - CRC Scrambled with RA-RNTI	gNB → UE
Random Access Response └MAC PDU └MAC Payload for Random Access Response └RAR UL Grant	gNB → UE
RRCSetupRequest	UE → gNB
PDCCH DCI Format 1_0 └Format 1_0 - CRC Scrambled with C-RNTI	gNB → UE
RRCSetup └RadioBearerConfig └CellGroupConfig	gNB → UE
PDCCH DCI Format 0_0 └Format 0_0 - CRC Scrambled with C-RNTI	gNB → UE
RRCSetupComplete └Registration Request	UE → gNB
Initial UE Message └Registration Request	gNB → New AMF
Namf_Communication_UEContextTransfer Request └Registration Request	New AMF → Old AMF
Namf_Communication_UEContextTransfer Response └UE Context in AMF	Old AMF → New AMF
Identity Request	New AMF → gNB → UE
Identity Response	UE → gNB → New AMF
Nausf_UEAuthenticate_authenticate Request	New AMF → AUSF
Nudm_UEAuthenticate_Get Request	AUSF → UDM
Nudm_UEAuthenticate_Get Response	UDM → AUSF

Message	Path
Nausf_UEAuthenticate_authenticate Response	AUSF → New AMF
Authentication Request	New AMF → gNB → UE
Authentication Response	UE → gNB → New AMF
NAS Security Mode Command	New AMF → gNB → UE
NAS Security Mode Complete	UE → gNB → New AMF
N5g-eir_EquipmentIdentityCheck Request	New AMF → 5G-EIR
N5g-eir_EquipmentIdentityCheck Response	5G-EIR → New AMF
Namf_Communication_RegistrationCompleteNotify	New AMF → Old AMF
Nudm_UEContextManagement_Registration Request └Amf3GppAccessRegistration	New AMF → UDM
Nudm_UEContextManagement_Registration Response	UDM → New AMF
Nudm_SubscriberDataManagement_Get Request	New AMF → UDM
Nudm_SubscriberDataManagement_Get Response └AccessAndMobilitySubscriptionData └SmfSelectionSubscriptionData └UeContextInSmfData	UDM → New AMF
Nudm_UEContextManagement_Deregistration_Notify	UDM → Old AMF
Nsmf_PDUSession_ReleaseSMContext	Old AMF → SMF
Npcf_AMPolicyControl_Create Request	New AMF → PCF
Npcf_AMPolicyControl_Create Response └PolicyAssociation └PolicyAssociationRequest	PCF → New AMF
Namf_EventExpose_Subscribe Request └AmfCreateEventSubscription └AmfEventSubscription	PCF → New AMF
Namf_EventExpose_Subscribe Response └AmfCreatedEventSubscription	New AMF → PCF
Npcf_AMPolicyControl_Delete Request	Old AMF → PCF
Npcf_AMPolicyControl_Delete Response	PCF → Old AMF
Nsmf_PDUSession_UpdateSMContext Request	New AMF → SMF
PFCP Session Modification Request	SMF → UDF

Message	Path
PFCP Session Modification Response	UDF → SMF
Nsmf_PDUSession_UpdateSMContext Response	SMF → New AMF
Initial Context Setup Request └─Registration Accept	New AMF → gNB
SecurityModeCommand	gNB → UE
SecurityModeComplete	UE → gNB
RRCReconfiguration └─Registration Accept └─RadioBearerConfig └─secondaryCellGroup └─MeasConfig └─masterCellGroup	gNB → UE
RRCReconfigurationComplete └─UplinkTxDirectCurrentList	UE → gNB
Initial Context Setup Response	gNB → New AMF
Registration Complete	UE → gNB
Nsmf_PDUSession_UpdateSMContext Request	New AMF → SMF
PFCP Session Modification Request	SMF → UDF
PFCP Session Modification Response	UDF → SMF
Nsmf_PDUSession_UpdateSMContext Response	SMF → New AMF

Preamble

UE → gNB

[TS 38.213](#), [TS 38.321](#), [TS 38.211](#)

The UE picks a random preamble. The preamble is referenced with the Random Access Preamble Id (RAPID). The preamble transmission is a Zadoff-Chu sequence.

Each preamble transmission is associated with an [RA-RNTI](#).

RA-RNTI

The RA-RNTI associated with the PRACH in which the Random Access Preamble is transmitted, is computed as:

$$\text{RA-RNTI} = 1 + s_id + 14 \times t_id + 14 \times 80 \times f_id + 14 \times 80 \times 8 \times ul_carrier_id$$

Where:

Identifier	Description
s_id	Index of the first OFDM symbol of the specified PRACH ($0 \leq s_id < 14$)
t_id	Index of the first slot of the specified PRACH in a system frame ($0 \leq t_id < 80$)
f_id	Index of the specified PRACH in the frequency domain ($0 \leq f_id < 8$)
ul_carrier_id	Uplink carrier used for Msg1 transmission (0 for NUL carrier, and 1 for SUL carrier)

PDCCH DCI Format 1_0

gNB → UE

[TS 38.212](#)

DCI Format 1_0 is used to assign downlink resources.

Format 1_0 - CRC Scrambled with RA-RNTI

In response to a PRACH transmission, a UE attempts to detect a DCI Format 1_0 with PDCCH CRC scrambled by the RA-RNTI corresponding to the RACH transmission. The UE looks for message during a configured window of length ra-ResponseWindow.

The RA-RNTI scrambled DCI message signals the frequency and time resources assigned for the transmission of the Transport Block containing the Random Access Response message.

The following information is transmitted by means of the RA-RNTI scrambled DCI Format 1_0:

Field	Bits
Frequency domain resource assignment	$\lceil \log_2(N_{RB}^{DL,BWP}(N_{RB}^{DL,BWP} + 1)/2) \rceil$ $N_{RB}^{DL,BWP}$ is the size of CORESET 0
Time domain resource assignment	4
VRB-to-PRB mapping	1
Modulation and coding scheme	5
TB scaling	2
Reserved bits	16

Format 1_0 - CRC Scrambled with C-RNTI

The following information is transmitted by a DCI Format 1_0 with PDCCH CRC scrambled by the assigned C-RNTI:



Field	Bits
Identifier of DCI formats	1
Frequency domain resource assignment	$\lceil \log_2(N_{RB}^{DL,BWP}(N_{RB}^{DL,BWP} + 1)/2) \rceil$ $N_{RB}^{DL,BWP}$ is the size of the active DL bandwidth part in case DCI format 1_0 is monitored in the UE specific search space if DCH sizes ≤ 4 and DCI size with C-RNTI ≤ 3 . Otherwise $N_{RB}^{DL,BWP}$ is the size of CORESET 0
Time domain resource assignment	4
VRB-to-PRB mapping	1
Modulation and coding scheme	5
New data indicator	1
Redundancy version	2
HARQ process number	4
Downlink assignment index	2
TPC command for scheduled PUCCH	2
PUCCH resource indicator	3
PDSCH-to-HARQ_feedback timing indicator	3

Random Access Response

gNB → UE

[TS 38.213](#), [TS 38.321](#)

1. The UE listens on the PDCCH addressed by the RA-RNTI.
2. Once the PDCCH with the RA-RNTI is decoded, the UE uses the RB resources in the message to receive the downlink transport block.
3. The downlink transport block contains the MAC PDU.
 - The UE MAC PDU consists of one or more MAC subPDUs.
 - Since multiple UEs may send a Preamble in the same RACH opportunity, they will all be addressed by the same RA-RNTI.
 - Thus, multiple Random Access Responses (RAR) may be carried in a single MAC PDU (They correspond to different UEs that initiated the random access procedure in the same RACH opportunity).

- Each RAR in the MAC PDU is addressed to a different UE via RAPID value.

MAC PDU

subPDU	1 bit	1 bit	6-bit	MAC subPDU payload
MAC subPDU 1	E	T	RAPID 1	MAC payload for Random Access Response
MAC subPDU 2	E	T	RAPID 2	MAC payload for Random Access Response
MAC subPDU 3	E	T	RAPID 3	MAC payload for Random Access Response
⋮				
MAC subPDU n				
Padding (optional)				

E/T/RAPID MAC subheader

1 bit	1 bit	6-bit
E	T	RAPID

MAC Payload for Random Access Response

Field	Description	Bits
R	Reserved bit (set to "0")	1
Timing Advance Command	The Timing Advance Command field indicates the index value TA used to control the amount of timing adjustment that the MAC entity must apply in TS 38.213.	12
RAR UL Grant	The Uplink Grant field indicates the resources to be used on the uplink in TS 38.213	27
Temporary C-RNTI	The Temporary C-RNTI field indicates the temporary identity that is used by the MAC entity during Random Access.	16

RAR UL Grant

RAR grant field	Number of bits
Frequency hopping flag	1
Msg3 PUSCH frequency resource allocation	14
Msg3 PUSCH time resource allocation	4
MCS	4

RAR grant field	Number of bits
TPC command for Msg3 PUSCH	3
CSI request	1

RRCSetupRequest

UE → gNB

38.331

The RRC Setup Request is sent with the random ue-Identity and an establishment cause. The following establishment causes are defined:

Establishment cause	Description
emergency	Emergency call
highPriorityAccess	High priority access
mt-Access	Mobile terminated access
mo-Signalling	Mobile originated signaling
mo-Data	Mobile Originated data
mo-VoiceCall	Mobile originated voice call
mo-VideoCall	Mobile originated video call
mo-SMS	Mobile originated SMS (Text)
mps-PriorityAccess	Multimedia priority service - priority access
mcs-PriorityAccess	Mission critical service - priority access

```

RRCSetupRequest ::= SEQUENCE {
    rrcSetupRequest
}

RRCSetupRequest-IEs ::= SEQUENCE {
    ue-Identity
    establishmentCause
    spare
}

InitialUE-Identity ::= CHOICE {
    ng-5G-S-TMSI-Part1
    randomValue
}

```

```

EstablishmentCause ::=
    ENUMERATED {
        emergency, highPriorityAccess,
        mt-Access, mo-Signalling,
        mo-Data, mo-VoiceCall,
        mo-VideoCall, mo-SMS, mps-PriorityAccess,
        mcs-PriorityAccess,
        spare6, spare5, spare4,
        spare3, spare2, spare1}

```

RRCSetup

gNB → UE

38.331

The RRC Setup message is sent to setup SRB1 and the master cell. The message carries the [radioBearerConfig](#) and [masterCellGroup](#) information elements.

```

RRCSetup ::=
    SEQUENCE {
        rrc-TransactionIdentifier
        criticalExtensions
            rrcSetup
            criticalExtensionsFuture
        }
    }

RRCSetup-IEs ::=
    SEQUENCE {
        radioBearerConfig
        masterCellGroup
        lateNonCriticalExtension
        nonCriticalExtension
    }

```

RadioBearerConfig

```

RadioBearerConfig ::=
    SEQUENCE {
        srb-ToAddModList
        SRB-ToAddModList
    OPTIONAL, -- Cond HO-Conn
        srb3-ToRelease
        ENUMERATED{true}
    OPTIONAL, -- Need N
        drb-ToAddModList
        DRB-ToAddModList
    OPTIONAL, -- Cond HO-toNR
        drb-ToReleaseList
        DRB-ToReleaseList
    OPTIONAL, -- Need N
        securityConfig
        SecurityConfig
    }

```



```

OPTIONAL,    -- Need M
    ...
}

SRB-ToAddModList ::=
SRB-ToAddMod ::=
    srb-Identity
    reestablishPDCP
OPTIONAL,    -- Need N
    discardOnPDCP
OPTIONAL,    -- Need N
    pdcp-Config
OPTIONAL,    -- Cond PDCP
    ...
}

DRB-ToAddModList ::=
DRB-ToAddMod ::=
    cnAssociation
        eps-BearerIdentity
-- EPS-DRB-Setup
    sdap-Config
-- 5GC
    }
    drb-Identity
    reestablishPDCP
OPTIONAL,    -- Need N
    recoverPDCP
OPTIONAL,    -- Need N
    pdcp-Config
OPTIONAL,    -- Cond PDCP
    ...
}

DRB-ToReleaseList ::=

SecurityConfig ::=
    securityAlgorithmConfig
OPTIONAL,    -- Cond RBTermChange
    keyToUse
OPTIONAL,    -- Cond RBTermChange
    ...
}

SEQUENCE (SIZE (1..2)) OF SRB-ToAddMod
SEQUENCE {
    SRB-Identity,
    ENUMERATED{true}
    ENUMERATED{true}
    PDCP-Config
}

SEQUENCE (SIZE (1..maxDRB)) OF DRB-ToAddMod
SEQUENCE {
    CHOICE {
        INTEGER (0..15),
        SDAP-Config
    }
    OPTIONAL, -- Cond DRBSetup
    DRB-Identity,
    ENUMERATED{true}
    ENUMERATED{true}
    PDCP-Config
}

SEQUENCE (SIZE (1..maxDRB)) OF DRB-Identity

SEQUENCE {
    SecurityAlgorithmConfig
    ENUMERATED{master, secondary}
}

```

CellGroupConfig

```

CellGroupConfig ::=
    cellGroupId

SEQUENCE {
    CellGroupId,
}

```

```

    rlc-BearerToAddModList          SEQUENCE (SIZE(1..maxLC-ID)) OF RLC-
BearerConfig                      OPTIONAL,  -- Need N
    rlc-BearerToReleaseList        SEQUENCE (SIZE(1..maxLC-ID)) OF
LogicalChannelIdentity            OPTIONAL,  -- Need N

    mac-CellGroupConfig            MAC-CellGroupConfig
OPTIONAL,  -- Need M

    physicalCellGroupConfig        PhysicalCellGroupConfig
OPTIONAL,  -- Need M

    spCellConfig                   SpCellConfig
OPTIONAL,  -- Need M
    sCellToAddModList              SEQUENCE (SIZE (1..maxNrofSCells)) OF
SCellConfig                      OPTIONAL,  -- Need N
    sCellToReleaseList             SEQUENCE (SIZE (1..maxNrofSCells)) OF
SCellIndex                        OPTIONAL,  -- Need N
    ...,
    [[
    reportUplinkTxDirectCurrent-v1530  ENUMERATED {true}
OPTIONAL  -- Cond BWP-Reconfig
    ]]
}

-- Serving cell specific MAC and PHY parameters for a SpCell:
SpCellConfig ::=
    servCellIndex                  ServCellIndex
OPTIONAL,  -- Cond SCG
    reconfigurationWithSync        ReconfigurationWithSync
OPTIONAL,  -- Cond ReconfWithSync
    rlf-TimersAndConstants          SetupRelease { RLF-TimersAndConstants }
OPTIONAL,  -- Need M
    rlmInSyncOutOfSyncThreshold     ENUMERATED {n1}
OPTIONAL,  -- Need S
    spCellConfigDedicated           ServingCellConfig
OPTIONAL,  -- Need M
    ...
}

ReconfigurationWithSync ::=
    spCellConfigCommon             ServingCellConfigCommon
OPTIONAL,  -- Need M
    newUE-Identity                  RNTI-Value,
t304                                ENUMERATED {ms50, ms100, ms150, ms200, ms500,
ms1000, ms2000, ms10000},
    rach-ConfigDedicated            CHOICE {
        uplink                       RACH-ConfigDedicated,
        supplementaryUplink           RACH-ConfigDedicated
    }
OPTIONAL,  -- Need N
    ...,

```

```

    [[
    smtc                                SSB-MTC OPTIONAL    -- Need S
    ]]
}

SCellConfig ::=                               SEQUENCE {
    sCellIndex                               SCellIndex,
    sCellConfigCommon                       ServingCellConfigCommon
OPTIONAL, -- Cond SCellAdd
    sCellConfigDedicated                   ServingCellConfig
OPTIONAL, -- Cond SCellAddMod
    ...,
    [[
    smtc                                SSB-MTC OPTIONAL    -- Need S
    ]]
}

```

PDCCH DCI Format 0_0

gNB → UE

[TS 38.212](#)

DCI Format 0_0 is used to assign uplink resources to the UE.

Format 0_0 - CRC Scrambled with C-RNTI

The following information is transmitted by a DCI Format 0_0 with PDCCH CRC scrambled by the assigned C-RNTI:

Field	Bits
Identifier of DCI formats	1
Frequency domain resource assignment	$\lceil \log_2(N_{RB}^{UL,BWP}(N_{RB}^{UL,BWP} + 1)/2) \rceil$ $N_{RB}^{UL,BWP}$ is the size of the active UL bandwidth part in case DCI format 0_0 is monitored in the UE specific search space if DCH sizes ≤ 4 and DCI size with C-RNTI ≤ 3 . Otherwise $N_{RB}^{UL,BWP}$ is the size of the initial UL bandwidth part.
Time domain resource assignment	4
Frequency hopping flag	1

Field	Bits
Modulation and coding scheme	5
New data indicator	1
Redundancy version	2
HARQ process number	4
Downlink assignment index	2
TPC command for scheduled PUSCH	2
UL/SUL indicator	1

RRCSetupComplete

UE → gNB

38.331

The UE sends the RRC Setup Complete message with a [Registration Request](#) in the dedicatedNAS-Message field.

```

RRCSetupComplete ::= SEQUENCE {
    rrc-TransactionIdentifier      RRC-TransactionIdentifier,
    criticalExtensions             CHOICE {
        rrcSetupComplete          RRCSetupComplete-IEs,
        criticalExtensionsFuture   SEQUENCE {}
    }
}

RRCSetupComplete-IEs ::= SEQUENCE {
    selectedPLMN-Identity         INTEGER (1..maxPLMN),
    registeredAMF                 RegisteredAMF
}

```

```

OPTIONAL,
  guami-Type                               ENUMERATED {native, mapped}
OPTIONAL,
  s-nssai-List                             SEQUENCE (SIZE (1..maxNrofS-NSSAI)) OF S-
NSSAI OPTIONAL,
  dedicatedNAS-Message                     DedicatedNAS-Message,
  ng-5G-S-TMSI-Value                       CHOICE {
    ng-5G-S-TMSI                           NG-5G-S-TMSI,
    ng-5G-S-TMSI-Part2                     BIT STRING (SIZE (9))
  }
  lateNonCriticalExtension                 OPTIONAL,
  lateNonCriticalExtension                 OCTET STRING
OPTIONAL,
  nonCriticalExtension                     SEQUENCE{}
OPTIONAL
}

RegisteredAMF ::=                          SEQUENCE {
  plmn-Identity                            PLMN-Identity
OPTIONAL,
  amf-Identifiaer                         AMF-Identifiaer
}
    
```

Registration Request

UE → RRCSetupComplete → gNB → NGAP Initial UE Message → New AMF → Namf_Communication_UEContextTransfer Request → Old AMF

TS 24.501

The Registration Request NAS message is carried from the UE to the newly assigned AMF. The message will also be passed to the old AMF to retrieve the AMF context for the UE.

Field	Type
Extended protocol discriminator	
Security header type	
Spare half octet	
Registration request message identity	Message type
5GS registration type	<ul style="list-style-type: none"> initial registration mobility registration updating periodic registration updating emergency registration
ngKSI	NAS key set identifier

Field	Type
Spare half octet	
5GS mobile identity	
Non-current native NAS key set identifier	NAS key set identifier
5GMM capability	
UE security capability	
Requested NSSAI	NSSAI
Last visited registered TAI	5GS tracking area identity
S1 UE network capability	
Uplink data status	
PDU session status	
MICO indication	
UE status	
Additional GUTI	5GS mobile identity
Allowed PDU session status	
UE's usage setting	
Requested DRX parameters	DRX parameters
EPS NAS message container	
LADN indication	
Payload container	

Initial UE Message

gNB → New AMF

[TS 38.413](#)

The gNB sends the Initial UE Message to the selected AMF. The message carries the [Registration Request](#) that was received from the UE in the RRC Setup Complete message. The "RAN UE NGAP ID" and the "RRC Establishment Cause" are also included in the message.

The AMF will use the "RAN UE NGAP ID" to address the UE context on the gNB.

Field	Description
-------	-------------

Field	Description
Message Type	
RAN UE NGAP ID	
NAS-PDU	Registration Request
User Location Information	
RRC Establishment Cause	OCTET STRING
5G-S-TMSI	
AMF Set ID	
UE Context Request	Indicates that a UE context including security information needs to be setup at the NG-RAN.
Allowed NSSI	

Namf_Communication_UEContextTransfer Request

New AMF → Old AMF

[29.502](#), [29.518](#)

New AMF requests context transfer from the Old AMF. The complete [NAS registration request message](#) received from the UE is included in the context request.

Field	Description
5G-GUTI	
Reason	
Registration Request	Integrity protected message from the UE that triggers the context transfer.

Namf_Communication_UEContextTransfer Response

Old AMF → New AMF

[29.502](#), [29.518](#)

The Old AMF passes the [AMF UE Context](#) to the new AMF.

Field	Description

Field	Description
UE Context in AMF	Integrity protected message from the UE that triggers the context transfer.
Mobile Equipment Identifier	Optional
Allowed NSSAI	
Mapping Of Allowed NSSAI	

UE Context in AMF

The complete UE context maintained at the AMF. The AMF passes this context to a "New AMF" if the UE is attempts registration in the "New AMF".

Field	Description
SUPI	SUPI (Subscription Permanent Identifier) is the subscriber's permanent identity in 5GS.
SUPI-unauthenticated-indicator	This indicates whether the SUPI is unauthenticated.
GPSI	The GPSI(s) of the UE. The presence is dictated by its storage in the UDM.
5G-GUTI	5G Globally Unique Temporary Identifier.
PEI	Mobile Equipment Identity
Internal Group ID-list	List of the subscribed internal group(s) that the UE belongs to.
UE Specific DRX Parameters	UE specific DRX parameters.
UE MM Network Capability	Indicates the UE MM network capabilities.
5GMM Capability	Includes other UE capabilities related to 5GCN or interworking with EPS.
Events Subscription	List of the event subscriptions by other CP NFs. Indicating the events being subscribed as well as any information on how to send the corresponding notifications

AM Policy Association Information includes the AM Policy Information and the PCF ID(s) below

Field	Description
-------	-------------

Field	Description
AM Policy Information	Information on AM policy provided by PCF. Includes the Policy Control Request Triggers and the Policy Control Request Information. Includes the authorized RFSP and the authorized Service Area Restrictions.
PCF ID(s)	The identifier of the PCF for AM Policy. In roaming, the identifier of V-PCF and H-PCF.
Subscribed RFSP Index	An index to specific RRM configuration in the NG-RAN that is received from the UDM.
RFSP Index in Use	An index to specific RRM configuration in the NG-RAN that is currently in use.
MICO Mode Indication	Indicates the MICO Mode for the UE.
Voice Support Match Indicator	An indication whether the UE radio capabilities are compatible with the network configuration. The AMF uses it as an input for setting the IMS voice over PS Session Supported Indication over 3GPP access.
Homogenous Support of IMS Voice over PS Sessions	Indicates per UE if "IMS Voice over PS Sessions" is homogeneously supported in all TAs in the serving AMF or homogeneously not supported, or, support is non-homogeneous/unknown.
UE Radio Capability for Paging Information	Information used by the NG-RAN to enhance the paging towards the UE.
Information on Recommended Cells And RAN nodes For Paging	Information sent by the NG-RAN, and used by the AMF when paging the UE to help determining the NG-RAN nodes to be paged as well as to provide the information on recommended cells to each of these NG-RAN nodes, in order to optimize the probability of successful paging while minimizing the signaling load on the radio path.
UE Radio Capability Information	Information sent by the NG-RAN node and stored in the AMF. The AMF sends this information to the NG-RAN node within the UE context during transition to CM-CONNECTED state.
SMSF Identifier	The Identifier of the SMSF serving the UE in RM REGISTERED state.
SMSF Address	The Address of the SMSF serving the UE in RM-REGISTERED state.
SMS Subscription	Indicates subscription to any SMS delivery service over NAS irrespective of access type.
SEAF data	Master security information received from AUSF

Field	Description
Last used EPS PLMN ID	The identifier of the last used EPS PLMN

For each access type level context within the UE access and mobility context:

Field	Description
Access Type	Indicates the access type for this context.
RM State	Registration management state.
Registration Area	Current Registration Area (a set of tracking areas in TAI List).
TAI of last Registration Update	TAI of the TA in which the last registration request was initiated.
User Location Information	Information on user location.
Mobility Restrictions	Mobility Restrictions restrict mobility handling or service access of a UE. It consists of RAT restriction, Forbidden area, Service area restrictions and Core Network type restriction.
Expected UE Behavior Parameters for AMF	Indicates per UE the Expected UE Behavior Parameters and their corresponding validity times.
Security Information for CP	Control plane security information.
Security Information for UP	User plane security information.
Allowed NSSAI	Allowed NSSAI consisting of one or more S-NSSAIs for serving PLMN in the present Registration Area.
Mapping Of Allowed NSSAI	Mapping Of Allowed NSSAI is the mapping of each S-NSSAI of the Allowed NSSAI to the S-NSSAIs of the Subscribed S-NSSAIs.
AMF UE NGAP ID	Identifies the UE association over the NG interface within the AMF as defined in TS 38.413.

Field	Description
RAN UE NGAP ID	Identifies the UE association over the NG interface within the NG-RAN node as defined in TS 38.413.
Network Slice Instance(s)	The Network Slice Instances selected by 5GC for this UE.

For each PDU Session level context:

Field	Description
S-NSSAI(s)	The S-NSSAI(s) associated to the PDU Session.
DNN	The associated DNN for the PDU Session.
Network Slice Instance id	The network Slice Instance information for the PDU Session
PDU Session ID	The identifier of the PDU Session.
SMF Information	The associated SMF identifier and SMF address for the PDU Session.
Access Type	The current access type for this PDU Session.
EBI-ARP list	The allocated EBI and associated ARP pairs for this PDU session.
5GSM Core Network Capability	The UEs 5GSM Core Network Capability as defined in TS 23.501.

Identity Request

New AMF → [DL NAS Transport](#) → gNB → [DLInformationTransfer](#) → UE

[TS 24.501](#)

The New AMF requests UE identity ([SUCI](#)) from the UE via a NAS message.

Field	Type
Extended protocol discriminator	
Security header type	
Spare half octet	
Identity request message identity	Message type
Identity type	5GS identity type
Spare half octet	

Identity Response

UE → [ULInformationTransfer](#) → gNB → [UL NAS Transport](#) → New AMF

[TS 24.501](#)

The UE responds to the Identity Request with [SUCI](#). The [SUCI](#) is derived from the public key of the Home PLMN.

Field	Type
Extended protocol discriminator	
Security header type	
Spare half octet	
Identity response message identity	Message type
Mobile identity	5GS mobile identity

Nausf_UEAuthenticate_authenticate Request

New AMF → AUSF

[TS 33.501](#)

The AMF requests UE authentication vectors and algorithm information from the AUSF - Authentication Server Function.

Resource URI: [{apiRoot}/nausf-auth/v1/ue-authentications](#)

Scenario	Authentication Method	Inputs
Initial authentication request		SUPI (Subscription Permanent Identifier) or SUCI (Subscription Concealed Identifier)
Subsequent authentication request	5G AKA	Authentication confirmation message with RES*
Subsequent authentication request	EAP-AKA'	EAP packet as described in RFC 4187 and RFC 5448

Nudm_UEAuthenticate_Get Request

AUSF → UDM

[TS 29.503](#)

The Authentication Server Function (AUSF) requests authentication vectors from the UDM - Unified Data Management function.

Field	Presence	Description
SUPI or SUCI, serving network name	Required	Subscriber Permanent Identifier (SUPI) or Subscriber Concealed Identifier (SUCI)
Synchronization Failure	Optional	Synchronization Failure indication and related information (i.e. RAND/AUTS).

Nudm_UEAuthenticate_Get Response

UDM → AUSF

[TS 29.503](#), [TS 33.501](#)

The UDM returns the authentication vectors to the AUSF.

Field	Presence	Description
Authentication method and data	Required	Authentication method and corresponding authentication data for a certain UE as identified by SUPI or SUCI input.
SUPI	Optional	Subscriber Permanent Identifier. Present if SUPI was specified in the input.

Nausf_UEAuthenticate_authenticate Response

AUSF → New AMF

[TS 33.501](#)

The response returns the master key which is used by AMF to derive NAS security keys and other security key(s).

Field	Authentication Method	Outputs
Authentication response	5G AKA	Authentication vector, or Authentication confirmation acknowledge message.
Authentication response	EAP-AKA'	EAP packet as described in RFC 4187 and RFC 5448
Authentication result		Master key which is used by AMF to derive NAS security keys and other security key(s).

Authentication Request

New AMF → [DL NAS Transport](#) → gNB → [DLInformationTransfer](#) → UE

[TS 24.501](#)

Initiate the authentication procedure with the UE. Send the key selector, RAND and AUTN to the UE.

Field	Type
Extended protocol discriminator	
Security header type	
Spare half octet	
Authentication request message identity	Message type
ngKSI	NAS key set identifier
Spare half octet	
Authentication parameter RAND (5G authentication challenge)	Authentication parameter RAND
Authentication parameter AUTN (5G authentication challenge)	Authentication parameter AUTN
ABBA	
EAP message	

Authentication Response

UE → [ULInformationTransfer](#) → gNB → [UL NAS Transport](#) → New AMF

[TS 24.501](#)

The UE responds to the authentication challenge.

Field	Type
Extended protocol discriminator	
Security header type	
Spare half octet	
Authentication response message identity	
Authentication response parameter	
EAP message	

NAS Security Mode Command

New AMF → [DL NAS Transport](#) → gNB → [DLInformationTransfer](#) → UE

[TS 24.501](#)

The AMF signals the selected NAS security algorithm to the UE. The AMF also requests the IMEISV from the UE.

Field	Type
Extended protocol discriminator	
Security header type	
Spare half octet	
Security mode command message identity	
Selected NAS security algorithms	
ngKSI	
Spare half octet	
Replayed UE security capabilities	
IMEISV request	
HashAMF	
Selected EPS NAS security algorithms	
Additional 5G security information	
EAP message	

NAS Security Mode Complete

UE → [ULInformationTransfer](#) → gNB → [UL NAS Transport](#) → New AMF

[TS 24.501](#)

The UE signals the completion of the NAS security procedure. The message contains the IMEISV.

Field	Type
Extended protocol discriminator	
Security header type	
Spare half octet	
Security mode complete message identity	Message type
IMEISV	5G mobility identity
NAS message container	

N5g-eir_EquipmentIdentityCheck Request

New AMF → 5G-EIR

[TS 23.502](#)

This service is provided by the 5G-EIR to check the PEI and determine whether the PEI is blacklisted.

Inputs**Outputs**

PEI and [SUPI](#) PEI checking result

N5g-eir_EquipmentIdentityCheck Response

5G-EIR → New AMF

[TS 23.502](#)

5G-EIR responds to the PEI blacklisting check.

Inputs**Outputs**

PEI and [SUPI](#) PEI checking result

Namf_Communication_RegistrationCompleteNotify

New AMF → Old AMF

[29.518](#), [23.502](#)

Field	Presence	Description
5G-GUTI	Required	5G Globally Unique Temporary Identity
PDU Session ID(s)	Optional	Indicates the PDU Session(s) to be released
PCF ID	Optional	Indicates that the PCF ID that handles the AM Policy association has changed

Nudm_UEContextManagement_Registration Request

New AMF → UDM

[TS 29.503](#)

Resource URI for 3GPP access:

```
://{apiRoot}/nudm_uecm/v1/{ueid}/registrations/amf-3gpp-access
```

Here:

{ueid} Represents the Subscription Identifier SUPI or GPSI (see 3GPP TS 23.501) [SUPI](#) (i.e. imsi or nai) is used with the PUT and PATCH methods; GPSI (i.e. msisdn or extid) is used with the GET method. The ueid pattern is:

```
"(imsi-[0-9]{5,15}|nai-.+|msisdn-[0-9]{5,15}|extid-.+|.+)"
```

HTTP/Custom method	Description	Body datastructure
PUT	Update the AMF registration for 3GPP access	Amf3GppAccessRegistration
PATCH	Modify the AMF registration for 3GPP access	Amf3GppAccessRegistrationModification
GET	Retrieve the AMF registration information for 3GPP access.	

Amf3GppAccessRegistration

Attribute name	Data type	Presence	Cardinality	Description
amfInstancelid	NfInstancelid	M	1 T	The identity the AMF uses to register in the NRF.
supportedFeatures	SupportedFeatures	O	0..1	
purgeFlag	PurgeFlag	O	0..1	This flag indicates whether or not the AMF has deregistered. It shall not be included in the Registration service operation.
pei	Pei	O	0..1	Permanent Equipment Identifier.
imsVoPS	ImsVoPS	O	0..1	Indicates per UE if "IMS Voice over PS Sessions" is homogeneously supported in all TAs in the serving AMF, or homogeneously not supported.

Attribute name	Data type	Presence	Cardinality	Description
deregCallbackUri	Uri	M	1	A URI provided by the AMF to receive (implicitly subscribed) notifications on deregistration.
pcscfRestorationCallbackUri	Uri	O	0..1	A URI provided by the AMF to receive (implicitly subscribed) notifications on the need for P-CSCF Restoration.
guami	Guami	C	0..1	This IE shall contain the serving AMF's GUAMI.
backupAmfInfo	array(BackupAmfInfo)	C	0..N	This IE shall be included if the NF service consumer is an AMF and the AMF supports the AMF management without UDSF for the first interaction with UDM. The UDM uses this attribute to do an NRF query in order to invoke later services in a backup AMF, e.g. Namf_EventExposure.

Nudm_UEContextManagement_Registration Response

UDM → New AMF

[TS 29.503](#)

Data type	Presence	Cardinality	Response codes	Description
-----------	----------	-------------	----------------	-------------

[↑top](#)

Data type	Presence	Cardinality	Response codes	Description
n/a			204 No Content	Upon success, an empty response body shall be returned
ProblemDetails	M	1	404 Not Found	The "cause" attribute shall be set to the following application error: <ul style="list-style-type: none"> • USER_NOT_FOUND
ProblemDetails	M	1	403 Forbidden	The "cause" attribute shall be set to one of the following application errors: <ul style="list-style-type: none"> • UNKNOWN_5GS_SUBSCRIPTION • NO_PS_SUBSCRIPTION • ROAMING_NOT_ALLOWED • ACCESS_NOT_ALLOWED • RAT_NOT_ALLOWED • REAUTHENTICATION_REQUIRED

Nudm_SubscriberDataManagement_Get Request

New AMF → UDM

TS 29.503

Requested Data	HTTP Verb	URI
Access and Mobility Subscription data	GET	../{supi}/am-data
SMF Selection Subscription data	GET	../{supi}/smf-select-data
UE Context In SMF Data Retrieval	GET	../{supi}/ue-context-in-smf-data

Nudm_SubscriberDataManagement_Get Response

UDM → New AMF

TS 29.503

Provided Data	HTTP Verb	Provided Data Type
Access and Mobility Subscription data	200 OK	AccessAndMobilitySubscriptionData
SMF Selection Subscription data	200 OK	SmfSelectionSubscriptionData
UE Context In SMF Data Retrieval	200 OK	UeContextInSmfData

AccessAndMobilitySubscriptionData

Attribute name	Data type	Presence	Cardinality	Description
supportedFeatures	SupportedFeatures	O	0..1	
gpsis	array(Gpsi)	O	0..N	List of Generic Public Subscription Identifier; see 3GPP TS 29.571
internalGroupIds	array(InternalGroupId)	O	0..N	List of internal group identifier; see 3GPP TS 23.501
subscribedUeAmbr	Ambr	O	0..1	
nssai	Nssai	O	0..1	Network Slice Selection Assistance Information
ratRestrictions	array(RatType)	O	0..N	List of RAT Types that are restricted; see 3GPP TS 29.571
forbiddenAreas	array(Area)	O	0..N	List of forbidden areas
serviceAreaRestrictions	ServiceAreaRestriction	O	0..1	Subscribed Service Area Restriction
coreNetworkTypeRestrictions	array(CoreNetworkType)	O	0..N	List of Core Network Types that are restricted
rfspIndex	RfspIndex	O	0..1	Index to RAT/Frequency Selection Priority

Attribute name	Data type	Presence	Cardinality	Description
subsRegTimer	DurationSec	O	0..1	Subscribed periodic registration timer; see 3GPP TS 29.571
ueUsageType	UeUsageType	O	0..1	
mpsPriority	MpsPriorityIndicator	O	0..1	
activeTime	DurationSec	O	0..1	subscribed active time for PSM UEs
dIPacketCount	DIPacketCount	O	0..1	DL Buffering Suggested Packet Count indicates whether extended buffering of downlink packets for High Latency Communication is requested.
sorInfo	SorInfo	O	0..1	This IE shall be present if the UDM shall send the information for Steering of Roaming during registration or the subscription data update to the UE.
micoAllowed	MicoAllowed	O	0..1	Indicates whether the UE subscription allows MICO mode.

Attribute name	Data type	Presence	Cardinality	Description
sharedDataId	array(SharedDataId)	O	0..N	Identifier of shared data

```

/{supi}/am-data:
  get:
    summary: retrieve a UE's Access and Mobility Subscription Data
    operationId: Get
    tags:
      - Access and Mobility Subscription Data Retrieval
    parameters:
      - name: supi
        in: path
        description: Identifier of the UE
        required: true
        schema:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/Supi'
      - name: supported-features
        in: query
        description: Supported Features
        schema:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/SupportedFeatures'
      - name: plmn-id
        in: query
        description: serving PLMN ID
        content:
          application/json:
            schema:
              $ref: 'TS29571_CommonData.yaml#/components/schemas/PlmnId'
    responses:
      '200':
        description: Expected response to a valid request
        content:
          application/json:
            schema:
              $ref: '#/components/schemas/AccessAndMobilitySubscriptionData'
      '404':
        description: User (SUPI) does not exist
    default:
      description: Unexpected error
      content:
        application/problem+json:
          schema:
            $ref: 'TS29571_CommonData.yaml#/components/schemas/ProblemDetails'

```

Attribute name	Data type	Presence	Cardinality	Description
supportedFeatures	SupportedFeatures	O	0..1	
subscribedSnssaiInfos	array(SnssaiInfo)	O	0..N	List of S-NSSAIs and associated information (DNN Info); see 3GPP TS 23.501

```

/{supi}/smf-select-data:
  get:
    summary: retrieve a UE's SMF Selection Subscription Data
    operationId: Get
    tags:
      - SMF Selection Subscription Data Retrieval
    parameters:
      - name: supi
        in: path
        description: Identifier of the UE
        required: true
        schema:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/Supi'
      - name: supported-features
        in: query
        description: Supported Features
        schema:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/SupportedFeatures'
      - name: plmn-id
        in: query
        description: serving PLMN ID
        content:
          application/json:
            schema:
              $ref: 'TS29571_CommonData.yaml#/components/schemas/PlmnId'
    responses:
      '200':
        description: Expected response to a valid request
        content:
          application/json:
            schema:
              $ref: '#/components/schemas/SmfSelectionSubscriptionData'
      '404':
        description: User (SUPI) does not exist
    default:
      description: Unexpected error
      content:
        application/problem+json:
          schema:
            $ref: 'TS29571_CommonData.yaml#/components/schemas/ProblemDetails'

```

UeContextInSmfData

Attribute name	Data type	Presence	Cardinality	Description
pduSessions	map(PduSession)	O	0..N	A map (list of key-value pairs where pduSessionId converted from integer to string serves as key) of PduSessions.
pgwInf	array(PgwInfo)	O	0..N	Information about the DNNs/APNs and PGW-C+SMF FQDNs used in interworking with EPS

```

/{supi}/ue-context-in-smf-data:
  get:
    summary: retrieve a UE's UE Context In SMF Data
    operationId: Get
    tags:
      - UE Context In SMF Data Retrieval
    parameters:
      - name: supi
        in: path
        description: Identifier of the UE
        required: true
        schema:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/Supi'
      - name: supported-features
        in: query
        description: Supported Features
        schema:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/SupportedFeatures'
    responses:
      '200':
        description: Expected response to a valid request
        content:
          application/json:
            schema:
              $ref: '#/components/schemas/UeContextInSmfData'
      '404':
        description: User (SUPI) does not exist
    default:
      description: Unexpected error
      content:
        application/problem+json:
          schema:
            $ref: 'TS29571_CommonData.yaml#/components/schemas/ProblemDetails'

```


Nudm_UEContextManagement_Deregistration_Notify

UDM → Old AMF

[TS 29.503](#)

The following procedure using the DeregistrationNotification service operation is supported:

- UDM initiated NF Deregistration
 1. The UDM sends a POST request to the callbackReference as provided by the Old AMF during the registration (See [Amf3GppAccessRegistration](#) deregCallbackUri field) .
 2. The Old AMF service consumer responds with "204 No Content".

Nsmf_PDUSession_ReleaseSMContext

Old AMF → SMF

[TS 23.502](#)

This message allows to release the AMF-SMF association for a certain PDU Session because the PDU Session has been released.

Input	Presence
SUPI	Required
PDU Session ID	Required
UE location information	Optional
AN type	Optional
UE Time Zone	Optional

Npcf_AMPolicyControl_Create Request

New AMF → PCF

[29.513](#), [29.507](#)

URI organization:

```
{apiRoot}/{apiName}/{apiVersion}/{apiSpecificResourceUriPart}
```

- The `{apiRoot}` shall be set as described in 3GPP TS 29.501.
- The `{apiName}` shall be "npcf-am-policy-control".

- The `{apiVersion}` shall be "v1".
- The `{apiSpecificResourceUriPart}` specifies the API specific string.

Resource name	Resource URI	HTTP method or custom operation	Description
AM Policies	<code>{apiRoot}/npcf-am-policy-control/v1/policies/</code>	POST	Create a new Individual AM Policy
Individual AM Policy	<code>{apiRoot}/npcf-am-policy-control/v1/policies/{polAssold}</code>	GET	Read the Individual AM Policy resource.
Individual AM Policy	<code>{apiRoot}/npcf-am-policy-control/v1/policies/{polAssold}</code>	DELETE	Delete the Individual AM Policy resource.
Individual AM Policy	<code>{apiRoot}/npcf-am-policy-control/v1/policies/{polAssold}/update</code>	update (POST)	Report observed event trigger and obtain updated policies.

Npcf_AMPolicyControl_Create Response

PCF → New AMF

[29.513](#), [29.507](#)

Data type	Presence	Cardinality	Response codes	Description
PolicyAssociation	M	1	200 OK	

PolicyAssociation

Attribute name	Data type	Presence	Cardinality	Description
request	PolicyAssociationRequest	O	0..1	The information provided by the NF service consumer when requesting the creation of a policy association
uePolicy	FFF	O	0..1	The UE policy as determined by the PCF.
triggers	array(RequestTrigger)	O	1..N	Request Triggers that the PCF subscribes. Only values "LOC_CH" and "PRA_CH" are permitted.

Attribute name	Data type	Presence	Cardinality	Description
servAreaRes	FFS	O	0..1	Service Area Restriction as part of the AMF Access and Mobility Policy as determined by the PCF
rfsp	RfspIndex	O	0..1	RFSP Index as part of the AMF Access and Mobility Policy as determined by the PCF.
pras	map(PresenceInfo)	C	1..N	If the Trigger "PRA_CH" is provided, the presence reporting area(s) for which reporting is requested shall be provided. The prald attribute within the PresenceInfo data type shall also be the key of the map. The praStatus attribute within the PresenceInfo data type shall not be supplied.
suppFeat	SupportedFeatures	M	1	Indicates the negotiated supported features.

PolicyAssociationRequest

Attribute name	Data type	Presence	Cardinality	Description
notificationUri	Uri	M	1	Identifies the recipient of Notifications sent by the PCF.
altNotifIpv4Addrs	array(Ipv4Addr)	O	1..N	Alternate or backup IPv4 Address(es) where to send Notifications.
altNotifIpv6Addrs	array(Ipv6Addr)	O	1..N	Alternate or backup IPv6 Address(es) where to send Notifications.
supi	Supi	C	0..1	Subscription Permanent Identifier (~IMSI in 4G).
gpsi	Gpsi	C	0..1	Generic Public Subscription Identifier.
accessType	AccessType	C	0..1	The Access Type where the served UE is camping.

Attribute name	Data type	Presence	Cardinality	Description
pei	Pei	C	0..1	The Permanent Equipment Identifier of the served UE.
userLoc	UserLocation	C	0..1	The location of the served UE.
timeZone	TimeZone	C	0..1	The time zone where the served UE is camping.
servingPlmn	NetworkId	C	0..1	The serving PLMN where the served UE is camping.
ratType	RatType	C	0..1	The RAT Type where the served UE is camping.
groupId	GroupId	C	0..1	Internal Group Identifier of the served UE.
hPcfd	string	C	0..1	H-PCF Identifier.
servAreaRes	ServiceAreaRestriction	C	0..1	Service Area Restriction as part of the AMF Access and Mobility Policy.
rfsp	RfspIndex	C	0..1	RFSP Index as part of the AMF Access and Mobility Policy.
uePolReq	UePolicyRequest	C	0..1	A request for UE Policies. Shall be provided when the AMF receives an "UPSI LIST TRANSPORT" message.
guami	Guami	C	0..1	The Globally Unique AMF Identifier (GUAMI) shall be provided by an AMF as service consumer.
serviceName	string	O	0..1	If the NF service consumer is an AMF, it should provide the name of a service produced by the AMF that makes use of information received within the Npcf_AMPolicyControl_UpdateNotify service operation.
suppFeat	SupportedFeatures	M	1	Indicates the features supported by the service consumer.
traceReq	TraceData	C	0..1	Trace control and configuration parameters information defined in 3GPP TS 32.422 shall be included if trace is required to be activated.

Namf_EventExpose_Subscribe Request

PCF → New AMF

[29.518](#), [23.502](#)

Applications can subscribe to AMF events by sending a Subscription Request.

Resource URI: `{apiRoot}/namf-evts/v1/subscriptions`

The PCF can register for the following events:

Event	Description
Location-Report	A NF subscribes to this event to receive the Last Known Location of a UE or a group of UEs, and Updated Location of the UE or any UE in the group when AMF becomes aware of a location change of the UE.
Presence-In-AOI-Report	A NF subscribe to this event to receive the current present state of a UE in a specific Area of Interest (AOI), and notification when a specified UE enters or leaves the specified area. The area could be identified by a TA list, an area ID or specific interested area name like "LADN".
Time-Zone-Report	A NF subscribes to this event to receive the current time zone of a UE or a group of UEs, and updated time zone of the UE or any UE in the group when AMF becomes aware of a time zone change of the UE.
Access-Type-Report	A NF subscribes to this event to receive the current access type(s) of a UE or a group of UEs, and updated access type(s) of the UE or any UE in the group when AMF becomes aware of the access type change of the UE.
Registration-State-Report	A NF subscribes to this event to receive the current registration state of a UE or a group of UEs, and report for updated registration state of a UE or any UE in the group when AMF becomes aware of a registration state change of the UE.
Connectivity-State-Report	A NF subscribes to this event to receive the current connectivity state of a UE or a group of UEs, and report for updated connectivity state of a UE or any UE in the group when AMF becomes aware of a connectivity state change of the UE.
Reachability-Report	A NF subscribes to this event to receive the current reachability of a UE or a group of UEs, and report for updated reachability of a UE or any UE in the group when AMF becomes aware of a reachability change of the UE.
Subscribed-Data-Report	A NF subscribes to this event to receive the current Subscribed Data for the UE(s) received from UDM, and notification when AMF received updated subscribed data for the UE(s) from UDM.
Communication-Failure-Report	A NF subscribes to this event to receive the Communication failure report of a UE or group of UEs or any UE.

Event	Description
UEs-In-Area-Report	A NF subscribes to this event to receive the number of UEs in a specific area. A NF may ask AMF for the UEs within the area based on Last Known Location or it may request AMF to actively look for the UEs within the area based on Current Location.

URI: .../subscriptions ([AmfCreateEventSubscription](#))

AmfCreateEventSubscription

Attribute name	Data type	Presence	Cardinality	Description
subscription	AmfEventSubscription	M	1	Represents the AMF Event Subscription resource to be created.
supportedFeatures	SupportedFeatures	C	0..1	This IE shall be present if at least one optional feature is supported.

AmfEventSubscription

Attribute name	Data type	Presence	Cardinality	Description
eventList	array(AmfEvent)	M	1..N	Describes the events to be subscribed for this subscription.
notifyUri	Uri	M	1	Identifies the recipient of notifications sent by AMF for this subscription (NOTE 1)
notifyCorrelationId	string	M	1	Identifies the notification correlation ID. The AMF shall include this ID in the notifications.
nfId	NfInstanceId	M	1	Indicates the instance identity of the network function creating the subscription.

Attribute name	Data type	Presence	Cardinality	Description
subsChangeNotifyUri	Uri	C	0..1	This IE shall be present if the subscription is created by an NF service consumer on behalf of another NF (e.g UDM creating event subscription at AMF for event notifications towards NEF). When present, this IE Identifies the recipient of notifications sent by AMF for change of subscription ID (e.g during mobility procedures involving AMF change).
subsChangeNotifyCorelationId	string	C	0..1	This IE shall be present when an NF Service Consumer (e.g. UDM) is subscribing for events on behalf of another NF Service Consumer (e.g. NEF). When present, this IE shall contain the notification correlation ID. The AMF shall include it in the notifications for change of subscription ID.
supi	Supi	C	0..1	Subscription Permanent Identifier
groupId	GroupId	C	0..1	Identifies a group of UEs.
gpsi	Gpsi	C	0..1	Generic Public Subscription Identifier

Attribute name	Data type	Presence	Cardinality	Description
pei	Pei	C	0..1	Permanent Equipment Identifier
anyUE	boolean	C	0..1	This IE shall be present if the event subscription is applicable to any UE. Default value "FALSE" is used, if not present (NOTE 2)
options	AmfEventMode	O	0..1	This IE may be included if the NF service consumer wants to describe how the reports of the event to be generated.

Namf_EventExpose_Subscribe Response

New AMF → PCF

[29.518](#), [23.502](#)

Response code: **201 Created** is returned with [AmfCreatedEventSubscription](#)

A "201 Created" code signals successful subscription.

AmfCreatedEventSubscription

Attribute name	Data type	Presence	Cardinality	Description
subscription	AmfEventSubscription	M	1	Represents the newly created AMF Event Subscription resource.
reportList	array(AmfEventReport)	O	0..N	Represents the immediate event reports (i.e. the current value)
supportedFeatures	SupportedFeatures	C	0..1	This IE shall be present if at least one optional feature is supported.

Npcf_AMPolicyControl_Delete Request

Old AMF → PCF

[29.513](#), [29.507](#)

The Old AMF requests that the policy association is deleted as the corresponding UE context is terminated.

The old AMF will initiate the delete using the following URI:

```
{apiRoot}/npcf-am-policy-control/v1/policies/{polAssoId}
```

Npcf_AMPolicyControl_Delete Response

PCF → Old AMF

[29.513](#), [29.507](#)

PCF signals successful delete with **204 No Content** cause code.

Data type	Presence	Cardinality	Response codes	Description
n/a			204 No Content	Upon success, an empty response body shall be returned

Initial Context Setup Request

AMF → eNB

[38.413](#)

The purpose of the Initial Context Setup procedure is to establish the necessary overall initial UE Context at the NG-RAN node, when required, including PDU session context, the Security Key, Mobility Restriction List, UE Radio Capability and UE Security Capabilities, etc.

The AMF initiates a session setup with the gNB. The message typically contains the [Registration Accept](#) NAS message. The message carries one or more PDU Session setup requests. Each PDU session is addressed with the "PDU Session ID".

Field	Type
Message Type	
AMF UE NGAP ID	
RAN UE NGAP ID	
Old AMF	AMF Name

Field	Type
UE Aggregate Maximum Bit Rate	
Core Network Assistance Information	
GUAMI	

PDU Session Resource Setup Request List

PDU Session Resource Setup Request Item [PDU Session Id]

Field	Type
NAS-PDU	
PDU Session ID	
S-NSSAI	
PDU Session Resource Setup Request Transfer	OCTET STRING

Field	Type
Allowed NSSAI	
UE Security Capabilities	
Security Key	
Trace Activation	
Mobility Restriction List	
UE Radio Capability	
Index to RAT/Frequency Selection Priority	
Masked IMEISV	
NAS-PDU	
Emergency Fallback Indicator	
RRC Inactive Transition Report Request	

Registration Accept

New AMF → [Initial Context Setup Request](#) → gNB → [RRCReconfiguration](#) → UE

TS 24.501

Field	Type
-------	------

Field	Type
Extended protocol discriminator	
Security header type	
Spare half octet	
Registration accept message identity	
5GS registration result	
5G-GUTI	5GS mobile identity
Equivalent PLMNs	PLMN list
TAI list	5GS tracking area identity list
Allowed NSSAI	NSSAI
Rejected NSSAI	
Configured NSSAI	NSSAI
5GS network feature support	
PDU session status	
PDU session reactivation result	
PDU session reactivation result error cause	
LADN information	
MICO indication	
Network slicing indication	
Service area list	
T3512 value	GPS timer 3
Non-3GPP de-registration timer value	GPRS timer 2
T3502 value	GPRS timer 2
Emergency number list	
Extended emergency number list	
SOR transparent container	
EAP message	

SecurityModeCommand

gNB → UE

[38.331](#)

The SecurityModeCommand message is used to command the activation of AS security.

The UE performs the following actions on receiving the Security Mode Command:

- Derive the K-gNB key. K-gNB is a key derived by UE and AMF from K-AMF.
- Derive K-RRC-int key associated with the Integrity Protection Algorithm.
- Verify the integrity protection of the Security Mode Command message.
- Derive K-UP-int key associated with the Integrity Protection Algorithm.
- Start SRB Integrity Protect.

Reference: 3GPP TS 33.501 V15.2.0 (2018-09)

```

SecurityModeCommand ::=          SEQUENCE {
  rrc-TransactionIdentifier      RRC-TransactionIdentifier,
  criticalExtensions             CHOICE {
    securityModeCommand         SecurityModeCommand-IEs,
    criticalExtensionsFuture    SEQUENCE {}
  }
}

SecurityModeCommand-IEs ::=     SEQUENCE {
  securityConfigSMC             SecurityConfigSMC,

  lateNonCriticalExtension      OCTET STRING          OPTIONAL,
  nonCriticalExtension          SEQUENCE{}              OPTIONAL
}

SecurityConfigSMC ::=          SEQUENCE {
  securityAlgorithmConfig       SecurityAlgorithmConfig,
  ...
}

```

SecurityModeComplete

UE → gNB

[38.331](#)

The SecurityModeComplete message is used to confirm the successful completion of a security mode command. Ciphering will be enabled after sending this message. The Security Mode Complete message is itself not ciphered. The message is however integrity protected.

```

SecurityModeComplete ::=          SEQUENCE {
  rrc-TransactionIdentifier      RRC-TransactionIdentifier,
  criticalExtensions              CHOICE {
    securityModeComplete        SecurityModeComplete-IEs,
    criticalExtensionsFuture    SEQUENCE {}
  }
}

SecurityModeComplete-IEs ::=     SEQUENCE {
  lateNonCriticalExtension       OCTET STRING           OPTIONAL,
  nonCriticalExtension           SEQUENCE{}                  OPTIONAL
}

```

RRCReconfiguration

gNB → UE

38.331

The purpose of this message is to modify an RRC connection, e.g. to establish/modify/release RBs, to perform reconfiguration with sync, to setup/modify/release measurements, to add/modify/release SCells and cell groups. As part of the procedure, NAS dedicated information may be transferred from the Network to the UE.

The message carries the following fields:

- [Registration Accept](#)
- [masterCellGroup](#)
- [secondaryCellGroup](#)
- [radioBearerConfig](#)
- [MeasConfig](#)

```

RRCReconfiguration ::=          SEQUENCE {
  rrc-TransactionIdentifier      RRC-TransactionIdentifier,
  criticalExtensions              CHOICE {
    rrcReconfiguration          RRCReconfiguration-IEs,
    criticalExtensionsFuture    SEQUENCE {}
  }
}

RRCReconfiguration-IEs ::=     SEQUENCE {
  radioBearerConfig              RadioBearerConfig
  OPTIONAL, -- Need M
  secondaryCellGroup             OCTET STRING (CONTAINING CellGroupConfig)
  OPTIONAL, -- Need M
  measConfig                     MeasConfig
  OPTIONAL, -- Need M
  lateNonCriticalExtension       OCTET STRING
}

```

```

OPTIONAL,
    nonCriticalExtension                RRCReconfiguration-v1530-IEs
OPTIONAL
}

RRCReconfiguration-v1530-IEs ::=
    masterCellGroup                    SEQUENCE {
OPTIONAL, -- Need M
        fullConfig                      ENUMERATED {true}
OPTIONAL, -- Cond FullConfig
        dedicatedNAS-MessageList       SEQUENCE (SIZE(1..maxDRB)) OF
DedicatedNAS-Message                  OPTIONAL, -- Cond nonHO
        masterKeyUpdate                MasterKeyUpdate
OPTIONAL, -- Cond MasterKeyChange
        dedicatedSIB1-Delivery         OCTET STRING (CONTAINING SIB1)
OPTIONAL, -- Need N
        dedicatedSystemInformationDelivery OCTET STRING (CONTAINING
SystemInformation)                    OPTIONAL, -- Need N
        otherConfig                    OtherConfig
OPTIONAL, -- Need N
        nonCriticalExtension           SEQUENCE {}
OPTIONAL
}

MasterKeyUpdate ::=
    keySetChangeIndicator              BOOLEAN,
    nextHopChainingCount               NextHopChainingCount,
    nas-Container                      OCTET STRING
OPTIONAL, -- Cond securityNASC
    ...
}

```

MeasConfig

```

MeasConfig ::=
    measObjectToRemoveList             MeasObjectToRemoveList
OPTIONAL, -- Need N
    measObjectToAddModList            MeasObjectToAddModList
OPTIONAL, -- Need N

    reportConfigToRemoveList          ReportConfigToRemoveList
OPTIONAL, -- Need N
    reportConfigToAddModList          ReportConfigToAddModList
OPTIONAL, -- Need N

    measIdToRemoveList                MeasIdToRemoveList
OPTIONAL, -- Need N
    measIdToAddModList                MeasIdToAddModList

```

```

OPTIONAL,    -- Need N

    s-MeasureConfig                CHOICE {
        ssb-RSRP                    RSRP-Range,
        csi-RSRP                    RSRP-Range
    }                                OPTIONAL,    -- Need M

    quantityConfig                 QuantityConfig
OPTIONAL,    -- Need M

    measGapConfig                 MeasGapConfig
OPTIONAL,    -- Need M
    measGapSharingConfig         MeasGapSharingConfig
OPTIONAL,    -- Need M
    ...
}

MeasObjectToRemoveList ::=
MeasObjectId                SEQUENCE (SIZE (1..maxNrofObjectId)) OF

MeasIdToRemoveList ::=
MeasId                      SEQUENCE (SIZE (1..maxNrofMeasId)) OF MeasId

ReportConfigToRemoveList ::=
ReportConfigId             SEQUENCE (SIZE (1..maxReportConfigId)) OF

```

RRCReconfigurationComplete

gNB → New AMF

38.331

The RRC Reconfiguration Complete message is used to confirm the successful completion of an RRC connection reconfiguration.

```

RRCReconfigurationComplete ::=
    rrc-TransactionIdentifier
    criticalExtensions
        rrcReconfigurationComplete
        criticalExtensionsFuture
    }
}

RRCReconfigurationComplete-IEs ::=
    lateNonCriticalExtension
OPTIONAL,
    nonCriticalExtension
OPTIONAL
}

SEQUENCE {
    RRC-TransactionIdentifier,
    CHOICE {
        RRCReconfigurationComplete-IEs,
        SEQUENCE {}
    }
}

SEQUENCE {
    OCTET STRING
    RRCReconfigurationComplete-v1530-IEs
}

```

```
RRCReconfigurationComplete-v1530-IEs ::= SEQUENCE {
    uplinkTxDirectCurrentList          UplinkTxDirectCurrentList
OPTIONAL,
    nonCriticalExtension                SEQUENCE {}
OPTIONAL
}
```

UplinkTxDirectCurrentList

```
UplinkTxDirectCurrentList ::= SEQUENCE (SIZE (1..maxNrofServingCells)) OF
UplinkTxDirectCurrentCell

UplinkTxDirectCurrentCell ::= SEQUENCE {
    servCellIndex                ServCellIndex,
    uplinkDirectCurrentBWP       SEQUENCE (SIZE (1..maxNrofBWPs)) OF
UplinkTxDirectCurrentBWP,
    ...
}

UplinkTxDirectCurrentBWP ::= SEQUENCE {
    bwp-Id                       BWP-Id,
    shift7dot5kHz                BOOLEAN,
    txDirectCurrentLocation       INTEGER (0..3301)
}
```

Initial Context Setup Response

eNB → AMF

38.413

This message is sent by the NG-RAN node to confirm the setup of a UE context.

Field	Description
Message Type	
AMF UE NGAP ID	Identifies the UE context on the AMF.
RAN UE NGAP ID	Identifies the UE context on the RAN (gNB)
PDU Session Resource Setup Response List	
PDU Session Resource Setup Response Item [PDU Session Id]	
Field	Description



Field	Description
PDU Session ID	Identifies a PDU session
PDU Session Resource Setup Response Transfer	

PDU Session Resource Failed to Setup List

PDU Session Resource Failed to Setup Item [PDU Session ID]

Field	Description
PDU Session ID	Identifies PDU session
PDU Session Resource Setup Unsuccessful Transfer	

Criticality Diagnostics

Registration Complete

UE → [ULInformationTransfer](#) → gNB → [UL NAS Transport](#) → New AMF

[TS 24.501](#)

Field	Type
Extended protocol discriminator	
Security header type	
Spare half octet	
Registration complete message identity	Message type
SOR transparent container	

Nsmf_PDUSession_UpdateSMContext Request

New AMF → SMF

[TS 23.502](#)

This message updates the AMF-SMF association to support a PDU Session. The message also provides SMF with N1/N2 SM information received from the UE or from the AN.

Input	Presence
SUPI	Required

Input	Presence
Operation Type	<ul style="list-style-type: none"> • UP activate • UP deactivate • UP To Be Switched
PDU Session ID	Optional
N1 SM container received from the UE	Optional
N2 SM information received from the AN	Optional
Serving GW Address(es) and Serving GW DL TEID(s) for data forwarding during HO from 5GS to EPS.	Optional
UE location information	Optional
AN type	Optional
UE Time Zone	Optional
H-SMF identifier/address	Optional
EBI(s) to be revoked, PDU Session(s) to be re-activated	Optional
Direct Forwarding Flag	Optional
ARP list	Optional
S-NSSAI	Optional
Data Forwarding Tunnel (setup/release)	Optional
UE presence in LADN service area	Optional
Target ID	Optional
Target AMF ID	Optional
GUAMI	Optional
Backup AMF(s) (if NF Type is AMF)	Optional

PFCP Session Modification Request

SMF → UPF

[TS 29.244](#)

The [PFCP](#) Session Modification Request is used over the Sxa, Sxb, Sxc and N4 interface by the CP function to request the UP function to modify the [PFCP](#) session.

Information Element	Description
CP F-SEID	Change the fully qualified Session Id
Remove PDR	Remove Packet Detection Rule
Remove FAR	Remove Forwarding Action Rule
Remove URR	Remove Usage Reporting Rule
Remove QER	Remove QoS Enforcement Rule
Remove BAR	Remove Buffering Action Rule
Remove Traffic Endpoint	
Create PDR	Create Packet Detection Rule
Create FAR	Create Forwarding Action Rule
Create URR	Create Usage Reporting Rule
Create QER	Create QoS Enforcement Rule
Create BAR	Create Buffering Action Rule
Create Traffic Endpoint	
Update PDR	Update Packet Detection Rule
Update FAR	Update Forwarding Action Rule
Update URR	Update Usage Reporting Rule
Update QER	Update QoS Enforcement Rule
Update BAR	Update Buffering Action Rule
Update Traffic Endpoint	
	Update flags:
PFCSMReq-Flags	<ul style="list-style-type: none"> • DROBU (Drop Buffered Packets) • QAURR (Query All URRs)
Query URR	Query Usage Reporting Rule
User Plane Inactivity Timer	
Query URR Reference	Query Usage Reporting Rule Reference
Trace Information	

PCFP Session Modification Response

UPF → SMF

[TS 29.244](#)

The [PFCP](#) Session Modification Response shall be sent over the Sxa, Sxb, Sxc and N4 interface by the UP function to the CP function as a reply to the [PFCP](#) Session Modification Request.

Information Element	Description
Cause	Cause of acceptance or rejection of request
Offending IE	Included if rejecting due to an error in a specific IE of the request.
Create PDR	Create Packet Detection Rule
Load Control Information	
Overload Control Information	
Usage Report	
Failed Rule ID	This IE shall be included if the Cause IE indicates a rejection due to a rule creation or modification failure.
Additional Usage Reports Information	
Created/Updated Traffic Endpoint	

Nsmf_PDUSession_UpdateSMContext Response

SMF → New AMF

[TS 23.502](#)

Output	Presence
Result Indication	Required
PDU Session ID	Optional
Cause	Optional
released EBI list	Optional
allocated EBI information	Optional
N2 SM information	Optional
N1 SM container to be transferred to the AN/UE	Optional

NAS Transport

NAS traffic between the UE and the AMF is carried over NAS carrier messages in downlink and uplink.

DL NAS Transport

New AMF → gNB

TS 24.501

Field	Type
Extended protocol discriminator	
Security header type	
Spare half octet	
DL NAS TRANSPORT message identity	Message type
Payload container type	
Spare half octet	
Payload container	
PDU session ID	PDU session identity 2
Additional information	
5GMM cause	
Back-off timer value	GPRS Timer 3

DLInformationTransfer

gNB → UE

38.331

```

DLInformationTransfer ::= SEQUENCE {
    rrc-TransactionIdentifier RRC-TransactionIdentifier,
    criticalExtensions CHOICE {
        dlInformationTransfer DLInformationTransfer-IEs,
        criticalExtensionsFuture SEQUENCE {}
    }
}

DLInformationTransfer-IEs ::= SEQUENCE {
    dedicatedNAS-Message DedicatedNAS-Message OPTIONAL, -- Need N
    lateNonCriticalExtension OCTET STRING OPTIONAL,

```

```

    nonCriticalExtension          SEQUENCE {} OPTIONAL
  }

```

ULInformationTransfer

UE → gNB

38.331

```

ULInformationTransfer ::=          SEQUENCE {
    criticalExtensions              CHOICE {
        ulInformationTransfer      ULInformationTransfer-IEs,
        criticalExtensionsFuture   SEQUENCE {}
    }
}

ULInformationTransfer-IEs ::=     SEQUENCE {
    dedicatedNAS-Message           DedicatedNAS-Message           OPTIONAL,
    lateNonCriticalExtension       OCTET STRING                   OPTIONAL,
    nonCriticalExtension           SEQUENCE {}                       OPTIONAL
}

```

UL NAS Transport

gNB → New AMF

TS 24.501

Field	Type
Extended protocol discriminator	
Security header type	
Spare half octet	
UL NAS TRANSPORT message identity	Message type
Payload container type	
Spare half octet	
Payload container	
PDU session ID	PDU session identity 2
Old PDU session ID	PDU session identity 2
Request type	

Field	Type
S-NSSAI	
DNN	
Additional information	

5G Identifiers

Identifier	4G Equivalent	Description
SUPI	IMSI	Subscription Permanent Identifier is assigned to each subscriber accessing the 5G network.
SUCI	P-TMSI + MCC + MNC	Subscription Concealed Identifier is a global identifier that can keep the UE identity concealed. SUCI can also be used by visiting networks to get authentication vectors from the home network.
PEI	IMEI	Permanent Equipment Identifier is assigned to each UE accessing the 5G network.
GPSI		Generic Public Subscription Identifier is used for addressing a 3GPP subscription in non-3GPP networks.
5G-GUTI	GUTI	Unique global identifier for the UE that does not reveal the SUPI.
5G-S-TMSI	S-TMSI	Shortened form of 5G-GUTI that is used in radio signaling procedures. <5G-S-TMSI> = <AMF Set ID><AMF Pointer><5G-TMSI>

PFCP

TS 29.244

The Packet Forwarding Control Protocol (PFCP) standardizes the signaling between control plane and the user plane functions. PFCP is used on the N4 interface between the Session Management Function (SMF) and the User Plane Function (UPF).

PFCP Header

Field	Length (Octets)
Version/MP/S	1
Message type	1
Session Endpoint Identifier	8
Sequence Number	3

Field	Length (Octets)
Message Priority/Spare	1

PFCP Messages

Packet Forwarding Control Protocol defines the following messages for Sxa, Sxb, Sxc and N4 interfaces.

Value	Message	Sxa	Sxb	Sxc	N4
0	Reserved				
PFCP Node related messages					
1	PFCP Heartbeat Request	X	X	X	X
2	PFCP Heartbeat Response	X	X	X	X
3	PFCP PFD Management Request	-	X	X	X
4	PFCP PFD Management Response	-	X	X	X
5	PFCP Association Setup Request	X	X	X	X
6	PFCP Association Setup Response	X	X	X	X
7	PFCP Association Update Request	X	X	X	X
8	PFCP Association Update Response	X	X	X	X
9	PFCP Association Release Request	X	X	X	X
10	PFCP Association Release Response	X	X	X	X
11	PFCP Version Not Supported Response	X	X	X	X
12	PFCP Node Report Request	X	X	X	X
13	PFCP Node Report Response	X	X	X	X
14	PFCP Session Set Deletion Request	X	X	-	-
15	PFCP Session Set Deletion Response	X	X	-	-
16 to 49	For future use				
PFCP Session related messages					
50	PFCP Session Establishment Request	X	X	X	X
51	PFCP Session Establishment Response	X	X	X	X
52	PFCP Session Modification Request	X	X	X	X
53	PFCP Session Modification Response	X	X	X	X

Value	Message	Sxa	Sxb	Sxc	N4
54	PFCP Session Deletion Request	X	X	X	X
55	PFCP Session Deletion Response	X	X	X	X
56	PFCP Session Report Request	X	X	X	X
57	PFCP Session Report Response	X	X	X	X
58 to 99	For future use				
Other messages					
100 to 255	For future use				

5G specifications

Specification	Version	Description
TS 23.502	V15.3.0 (2018-09)	Procedures for the 5G System
TS 24.501	V15.1.0 (2018-09)	Non-Access-Stratum (NAS) protocol for 5G System (5GS); Stage 3
TS 29.244	V15.3.0 (2018-09)	Interface between the Control Plane and the User Plane nodes
TS 29.503	V15.1.0 (2018-09)	5G System; Unified Data Management Services; Stage 3
TS 29.507	V15.1.0 (2018-09)	5G System; Access and Mobility Policy Control Service; Stage 3
TS 29.513	V15.1.0 (2018-09)	5G System; Policy and Charging Control signalling flows and QoS parameter mapping; Stage 3
TS 29.514	V15.1.0 (2018-09)	5G System; Policy Authorization Service; Stage 3
TS 29.518	V15.1.0 (2018-09)	5G System; Access and Mobility Management Services; Stage 3
TS 33.501	V15.2.0 (2018-09)	Security architecture and procedures for 5G System
TS 38.211	V15.3.0 (2018-09)	NR; Physical channels and modulation
TS 38.212	V15.3.0 (2018-09)	NR; Multiplexing and channel coding

Specification	Version	Description
TS 38.213	V15.3.0 (2018-09)	NR; Physical layer procedures for control
TS 38.321	V15.3.0 (2018-09)	NR; Medium Access Control (MAC) protocol specification
TS 38.331	V15.3.0 (2018-09)	NR; Radio Resource Control (RRC); Protocol specification
TS 38.413	V15.1.0 (2018-09)	NG-RAN; NG Application Protocol (NGAP)