**3GPP TSG- SA1 Meeting # 105 S1-240235**

**Athens, Greece, 26 Feb - 1 March 2024** **(revision of S1-240210, 1-240052)**

**Source: Novamint, Thales, Airbus, Eutelsat Group, Fraunhofer IIS, TNO, ESA, SES, ETRI, vivo, SKY Perfect JSAT, Sateliot, Lockheed Martin, Hughes Network systems, CATT, Nokia, Nokia Shanghai Bell, OQ Technology, China Telecom, Firstnet, Honor, NEC**

**Title:** **New SID: Study on satellite access - Phase 4**

**Document for: Approval**

**Agenda Item: 7**

3GPP™ Work Item Description

Information on Work Items can be found at <http://www.3gpp.org/Work-Items>
See also the [3GPP Working Procedures](http://www.3gpp.org/specifications-groups/working-procedures), article 39 and the TSG Working Methods in [3GPP TR 21.900](http://www.3gpp.org/ftp/Specs/html-info/21900.htm)

Title: Study on satellite access - Phase 4

Acronym: FS\_5GSAT\_Ph4

Unique identifier:

Potential target Release: Rel-20

# 1 Impacts

{For Normative work, identify the anticipated impacts. For a Study, identify the scope of the study}

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Affects: | UICC apps | ME | AN | CN | Others (specify) |
| Yes |  | X | X | X |  |
| No |  |  |  |  |  |
| Don't know | X |  |  |  |  |

# 2 Classification of the Work Item and linked work items

## 2.1 Primary classification

|  |  |
| --- | --- |
| X | Study  |
|  | Normative – Stage 1 |
|  | Normative – Stage 2 |
|  | Normative – Stage 3 |
|  | Normative – Other\* |

**\* Other = e.g. testing**

## 2.2 Parent Work Item

|  |
| --- |
| Parent Work / Study Items  |
| Acronym | Working Group | Unique ID | Title (as in 3GPP Work Plan) |
|  |  |  |  |

### 2.3 Other related Work Items and dependencies

|  |
| --- |
| Other related Work /Study Items (if any) |
| Unique ID | Title | Nature of relationship |
| 770002  | Study on using Satellite Access in 5G | Previous Rel-16 work covering satellite access in 5GS related use cases and requirements (ref. TR22.822: FS\_5GSAT) |
| 790001 | New Services and Markets Technology Enablers– Phase 2 | Stage 1 work item of 5G system. |
| 720005 | New Services and Markets Technology Enablers | Stage 1 work item of 5G system |
| 800010 | Integration of Satellite Access in 5G | Rel-18 Stage-1 Normative Work on the support of satellite |
| 860005 | Integration of satellite systems in the 5G architecture (5GSAT\_ARCH) | Rel-18 Stage-2 Normative Work on the support of satellite |
| 930019 | Architecture support for NB-IoT/eMTC Non-Terrestrial Networks in EPS (IoT\_SAT\_ARCH\_EPS) | The work will take into account stage-2 Normative Work on the support of NB-IoT NTN in EPS |
| 920069 | NB-IoT/eMTC support for Non-Terrestrial Networks (LTE\_NBIOT\_eMTC\_NTN) | The work will take into account stage-2 Normative Work on the support of NB-IoT NTN in EPS |
| 960016 | Study on satellite access - Phase 3 | Rel-19 stage-1 study on the support of satellite access phase 3 (ref. TR22.865 FS\_5GSAT\_Ph3) |
| 1000024 | Satellite access - Phase 3 | Rel-19 stage-1 Normative Work on the support of satellite |
| 1010033 | Study on Integration of satellite components in the 5G architecture Phase 3 | Rel-19 stage-2 study on the support of satellite access phase 3 (FS\_5GSAT\_Ph3\_ARCH) |

# 3 Justification

New capabilities for satellite access such as Store and Forward Satellite operation and UE-Satellite-UE communication have been addressed in SA1 5GSat phase 3 for Release 19. First commercial deployments of 5G based satellite are happening and many new use cases/demands for satellite access emerging are to be addressed still in the context of 5G advanced (i.e. in Release 20).

These use cases and capabilities to be addressed in Rel-20 are the following:

1/ Support of Multicast and Broadcast Services (MBS) over Satellite

Broadcast services constitute more than 50% of the revenue of satellite operators today based on classical DVB systems. A migration to 3GPP based technology shall enable MBS services to be available to allow a smooth evolution of the satellite operator’s broadcast services. MBS has the potential to complement the terrestrial and satellite networks with an efficient means to multicast and broadcast content to the end users. which can provide substantial improvements, especially regarding efficient resource usage to distribute content, such as software updates, media content for example. It can complement as well unidirectional link services.

2/ Support for emergency calls/messaging and mission critical services via satellite

With the first commercial deployments of 5G based satellite, there is a strong demand for supporting 5G emergency communication and mission critical services via satellite (e.g., emergency call for automotive, emergency messaging for handsets or IoT devices, PWS). Given that the regulation is evolving at least with higher location accuracy requirements; there is therefore a need for enhanced support of emergency calls/messaging services and mission critical service by satellite access.

3/ Support for multi-orbits satellite access networks

Several satellite operators are expected to deploy multi-orbits satellite networks combining LEO, MEO and GEO leveraging as well the notion of regenerative payload on board the satellite. The impacts of such 3GPP based megaconstellation combining multi-orbits on the service requirements for satellite access needs to be studied (e.g. enablers for QoS/SLA management, energy consumption/traffic/resource management, roaming and handover aspects) in the context of 5G Advanced.

4/ Network selection between satellites or between satellites and terrestrial

With the deployments of different 3GPP based satellites accesses using different orbits LEO, MEO or GEO (for NR or IoT) including the deployment of megaconstellation combining multi-orbits, it is necessary to study the gap and potential new requirements of the network selection to support the different possibilities between multi orbits satellites or between satellites and terrestrial (e.g., policies depending on the location, selection based on metrics, part of mega constellation, availability of the coverage if discontinuous).

5/ Resilient UE-Satellite-UE communication with intermittent ground connectivity

There is a need to support more robust system resilience to enhance UE-Satellite- UE communication with intermittent ground connectivity for example in case of ground disaster or ground connection failure (ISL outage or feeder link failure).

6/ Satellite access network sharing with on-board network entities

With the expanding of satellites deployments, the satellite operators are expected to share satellite with on-board entities including RAN and CN to terrestrial MNOs based on different business models/needs considering the limited size of satellite to support multiple physical entities.

This study will analyse different scenarios of network sharing, security requirement (e.g., Lawful Interception), operator information provision mechanism, and associated requirements including roaming and charging to support different business models/needs as well as the potential regulatory requirements associated to the situation of a satellite network shared with different MNOs in different geographical areas.

7/ Robust notification alert to increase reachability via satellite access

There are several use cases where terrestrial networks are not available and users are relying solely on satellite to provide communication and are expecting to be reachable via satellite. However, when the UE is placed in pockets, backpacks, in vehicles, boats… it results in poor reception conditions which is leading to miss calls and messages. A robust notification alert will allow to address this problem of unreachability to UE in those conditions (e.g., low SNR conditions, NLOS channel conditions).

This study will analyse the service requirements associated to robust notification alert to increase reachability via satellite access and determine the necessary KPIs.

8) Support of IMS-based GEO satellite call service

Voice calls via standard mobile phones over satellite connections are becoming increasingly popular in the market. Considering enabling it as an anywhere/anytime service, GEO (Geostationary Earth Orbit) satellites offer a unique advantage in terms of global coverage. IMS service is firstly proposed in 3GPP as an access-agnostic service and in 5G system it was by default supported no matter the access technology is what. However, the aspect of when the access is GEO (e.g. NB-IoT NTN) is lacking the investigations, especially considering the limitations of GEO’s transmission rate, and propagation delay. Therefore, it is necessary to address the gaps between IMS service and GEO as satellite access.

In addition to the service requirements, KPIs for a 5G system with satellite access have been introduced in TS 22.261 (section 7.4) in the context of Rel-16. Since the KPIs for satellite access have not been updated and do not reflect KPIs for 5G Advanced for the satellite access. This is especially valid for service to vehicular/drone mounted devices for verticals as well as for IoT devices. It is important to review the KPIs of 5G satellite networks and potentially update them. Furthermore, there is a need to clarify KPIs associated to service continuity.

# 4 Objective

The objectives of this study are the following:

- to study new use cases and related regulatory requirements and identify new potential service requirements and enhancement for 5G system over satellite, including:

* Support of Multicast and Broadcast Services (MBS) over satellite
* Emergency communications (e.g. voice, SMS, PWS) and mission critical services via satellite
* Multi-orbits satellite networks
* Network selection between satellite access networks or between satellites access networks and terrestrial access networks
* Resilient UE-Satellite-UE communication with intermittent ground connectivity
* Satellite access networks sharing for network entities on-board satellite
* Robust notification alert to increase reachability via satellite access
* Enhancements to IMS voice call service when incorporating GEO as the integrated satellite access network

- to study use cases such as vehicular/drone mounted devices/IoT devices serving vertical through satellite access and identify the gap and potential updates of the related KPIs of 5G Advanced satellite networks including clarifying KPIs associated to service continuity

# 5 Expected Output and Time scale

|  |
| --- |
| New specifications {One line per specification. Create/delete lines as needed} |
| Type  | TS/TR number | Title | For info at TSG#  | For approval at TSG# | Rapporteur |
| Internal TR | 22.xxx | Study on satellite access - Phase 4 | TSG#106 | TSG#107 | Thierry Bérisot, Novamint, (tberisot@novamint.com)Co-rapporteurXu Xia, China Telecom(xiaxu@chinatelecom.cn) |

|  |
| --- |
| Impacted existing TS/TR {One line per specification. Create/delete lines as needed} |
| TS/TR No. | Description of change  | Target completion plenary# | Remarks |
|  |  |  |  |

# 6 Work item Rapporteur(s)

Rapporteur: Thierry Bérisot, Novamint, tberisot@novamint.com
Co-rapporteur: Xu Xia, China Telecom, xiaxu@chinatelecom.cn

# 7 Work item leadership

SA1

# 8 Aspects that involve other WGs

None

# 9 Supporting Individual Members

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| --- |
| Supporting IM name |
| Novamint |
| Thales |
| Airbus |
| Eutelsat Group |
| Fraunhofer IIS |
| TNO |
| SES |
| ESA |
| ETRI |
| Vivo |
| SKY Perfect JSAT Corporation |
| Sateliot |
| Lockheed Martin |
| Hughes Network systems |
| CATT |
| Nokia |
| Nokia Shanghai Bell |
| OQ Technology |
| China Telecom |
| Firstnet |
| Honor |
| NEC |
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