**SA WG2 Meeting #S2-147ES2-2107451**

**18 - 22 October, 2021, Electronic meeting**

Source: Thales, Xiaomi, Novamint, TNO

Title: New SID: 5GC enhancement for satellite access Phase 2

Document for: Approval

Agenda Item: 9.1.3

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 5GC enhancement for satellite access Phase 2

Acronym: FS\_ 5GSAT\_ARCH\_Ph2

Unique identifier:

Potential target Release: Rel-18

# 1 Impacts

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

# 2 Classification of the Work Item and linked work items

## 2.1 Primary classification

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|  |  |
| --- | --- |
|  | Feature |
|  | Building Block |
|  | Work Task |
| X | Study Item |

## 2.2 Parent Work Item

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

### 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 | Use cases and requirements for satellite access in 5G |
| 800048 | Stage 1 of 5GSAT | Service requirements of satellite access in 5G |
| 860010 | Guidelines for Extra-territorial 5G Systems | New regulatory requirements |
| 800026 | Study on architecture aspects for using satellite access in 5G | Unresolved key issue leftover from R17 |
| 860005 | (Stage 2 of) Integration of satellite components in the 5G architecture | Baseline of 5G architecture to support satellite access |
| 890022 | Study on vehicle-mounted relays | Service requirements related to satellite access |

Dependency on non-3GPP (draft) specification:

# 3 Justification

5GSAT\_ARCH has been developed in R17 to address service requirements of satellite access in 5G, however, some aspects have not been considered nor fully realized:

* .
* **Relay based architecture including satellite**: UE may access 5GS network via a relay, which corresponds to either an IAB node or a relay UE. Assuming that the relay has both satellite access and terrestrial access capability, the relay may be assisted to determine whether to use satellite access and/or terrestrial access for the connection.
* For the support of **broadcast/multicast**, while it may be more efficient for the delivery of content by taking advantage of satellites, it may bring problem for the location dependent content transfer and MBS Service Area, as the coverage of one cell over satellite access may include multiple counties or across country boarders. Different UE or UE category may require differentiated QoS to be supported by satellite access. When UEs are temporarily out of coverage due to discontinuous coverage or regenerative payload, store and forward of broadcast/multicast content may be needed in the network. When both satellite path and terrestrial path are available, the performance of each path may be different for the delivery of broadcast/multicast content.
* NGSO regenerative-based satellite access is to be considered in the following use cases:
  + **RAN mobility impact to CN**: Key Issue #6 left over from R17, as defined in TR 23.737, due no support of NGSO regenerative-based satellite access by RAN in R17

Besides, there are also features proposed in RAN WG having 5GC impact, i.e. **Discontinuous coverage**. Dynamic support of discontinuous coverage is required for initial NGSO constellation deployment but as well to support evolution of the constellations such as loss of satellites, different releases supported in a given constellation. UE may have access to satellite service coverage only at specific time and places due to sparse constellation. UE location may not be timely aware of by the network to enable efficient paging, due to which mobility management mechanism needs to be enhanced. Moreover, UE may not always have to stay awake for the sake of power efficiency, especially for MIoT UE. Hence, the prediction, mechanisms on awareness & notification of UE wake-up time and data storage & forwarding for UEs temporarily out of coverage may be needed. There is also an important aspect of discontinuous coverage related to dynamic GEO systems where beams/cells are intermittent due to use of dynamic beam configuration.

In summary, several enhancements to 5GC have to be considered for satellite access in Rel18, in collaboration with RAN TSGs

# 4 Objective

The study item aims at investigating on further 5GC enhancements to support satellite access based on the R17 5GSAT\_ARCH achievements with the following 5GC areas for study:

Objectives related with performance improvement:

Objectives related with new features:

* WT#4: Discontinuous coverage

WT#4.1: Architectural enhancements to support discontinuous coverage for mobility enhancement (e.g. paging enhancement)

WT#4.2: Architectural enhancements considering prediction, awareness & notification of UE wake-up time, power saving optimizations.

* WT#7: NGSO regenerative payload

WT#7.1: Mobility management enhancements in CN due to RAN mobility

Note: whether to consider 5G NR NGSO regenerative-based satellite access depends on RAN conclusions.

## TU estimates and dependencies

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Work Task ID | TU Estimate  (Study) | TU Estimate  (Normative) | RAN Dependency  (Yes/No/Maybe) | Inter Work Tasks Dependency |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
| WT#4 | 1.5 | 1 |  | WT#4 is self-contained. |
| WT#4.1 | 2 | 0.5 | Yes |  |
| WT#4.2 | 2 | 0.5 | Yes |  |
| WT#5 | 1 | 1 |  | WT#5 is self-contained. |
| WT#5.1 | 3 | 0.25 | Yes |  |
| WT#5.2 | 0.25 | 0.25 | Yes |  |
| WT#5.3 | 0.25 | 0.25 | Yes |  |
| WT#5.4 | 1 | 0.25 | Yes |  |
|  |  |  |  |  |
| WT#7 | 1 | 0.5 |  | WT#7 is self-contained. |
| WT#7.1 | 2 | 0.25 | Maybe |  |
|  |  |  |  |  |

Total TU estimates for the study phase: 13

Total TU estimates for the normative phase: 5

Total TU estimates 13+5 = 18

# 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 | 23.xyz | Study on Integration of satellite components in the 5G architecture Phase II | SA#96 (June. 2022) | SA#97 (Sept. 2022) | Fine, Jean-Yves , Thales, [jean-yves.fine@thalesgroup.com](mailto:jean-yves.fine@thalesgroup.com)  Shen, Sherry (Yang), Xiaomi, [shenyang6@xiaomi.com](mailto:shenyang6@xiaomi.com) |

|  |  |  |  |
| --- | --- | --- | --- |
| 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: Fine, Jean-Yves, Thales, [jean-yves.fine@thalesgroup.com](mailto:jean-yves.fine@thalesgroup.com).

Co-rapporteur: Shen, Sherry (Yang), Xiaomi, [shenyang6@xiaomi.com](mailto:shenyang6@xiaomi.com), in charge of work items related to new features.

# 7 Work item leadership

SA2

# 8 Aspects that involve other WGs

SA3 for the Security aspects, SA5 for the Charging aspects, RAN for the RAN related issues.

# 9 Supporting Individual Members

|  |
| --- |
| Supporting IM name |
| Thales |
| Xiaomi |
| OPPO |
| Tencent |
| ESA |
| Avanti |
| Gatehouse Satcom |
| Sateliot |
| Intelsat |
| Ligado |
| TNO |
| Novamint |
| Gilat Satelite networks Ltd |
| Inmarsat |
| Hughes Network Systems |
| Hispasat |
| SES |
| CATT |
| Eutelsat |