**3GPP TSG-WG SA2 Meeting #170S2-2507574**

**25-29 August 2025, Goteborg, Sweden *(revision of S2-2507466)***

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| *CR-Form-v12.2* |
| **CHANGE REQUEST** |
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|  | **23.228** | **CR** | **1609** | **rev** | **4** | **Current version:** | **19.3.0** |  |
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| *For* [***HE******LP***](http://www.3gpp.org/3G_Specs/CRs.htm#_blank)*on using this form: comprehensive instructions can be found at* [*http://www.3gpp.org/Change-Requests*](http://www.3gpp.org/Change-Requests)*.* |
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| ***Proposed change affects:*** | UICC apps |  | ME |  | Radio Access Network |  | Core Network | **X** |

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| ***Title:***  | Update to Mobility procedures for UE-Satellite-UE communication |
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| ***Source to WG:*** | Ericsson |
| ***Source to TSG:*** | SA2 |
|  |  |
| ***Work item code:*** | 5GSAT\_Ph3-ARC |  | ***Date:*** | 2025-07-10 |
|  |  |  |  |  |
| ***Category:*** | **F** |  | ***Release:*** | Rel-19 |
|  | *Use one of the following categories:****F*** *(correction)****A*** *(mirror corresponding to a change in an earlier release)****B*** *(addition of feature),* ***C*** *(functional modification of feature)****D*** *(editorial modification)*Detailed explanations of the above categories canbe found in 3GPP [TR 21.900](http://www.3gpp.org/ftp/Specs/html-info/21900.htm). | *Use one of the following releases:Rel-8 (Release 8)Rel-9 (Release 9)Rel-10 (Release 10)Rel-11 (Release 11)…Rel-16 (Release 16)Rel-17 (Release 17)Rel-18 (Release 18)Rel-19 (Release 19)* |
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| ***Reason for change:*** | Align the terminology used in the procedure to that used in 23.502. Editorial changes. |
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| ***Summary of change:*** | Replace the term positive response with the acknowledgement of notifications about UP path management events; being the actual terminology used in the 23.502.  |
|  |  |
| ***Consequences if not approved:*** | Potential ambiguity |
|  |  |
| ***Clauses affected:*** | AE.5.2.1, AE.5.2.2 |
|  |  |
|  | **Y** | **N** |  |  |
| ***Other specs*** |  | **X** |  Other core specifications  | TS/TR ... CR ...  |
| ***affected:*** |  | **X** |  Test specifications | TS/TR ... CR ...  |
| ***(show related CRs)*** |  | **X** |  O&M Specifications | TS/TR ... CR ...  |
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| ***Other comments:*** |  |
|  |  |
| ***This CR's revision history:*** |  |

---Start of the 1st Change---

## AE.5.2 IMS AGW relocation and media routing path change due to change of satellites

### AE.5.2.1 Continued optimized media routing procedure

Figure AE.5.2.1-1 depicts a signalling flow diagram for continuation of optimized media routing after change of satellites serving a UE. The procedure depicts a change of satellite in the originating network. Change of satellite can occur in the terminating network as well.

NOTE 1: IMS entities not relevant for the procedure are omitted below for brevity of the description.

NOTE 2: In this Release of the specification, the originating network and the terminating network are the same PLMN.

Use of the N5 interface between IMS and 5GC is assumed.

Based on the procedure described in clause AE.5.1, P-CSCF is expected to subscribe to 5GC for the early and the late notification of the satellite user plane management events associated with UE-Satellite-UE communication media traffic as specified in clause 5.6.7 of TS 23.501 [93] and clause 4.3.6.3 of TS 23.502 [94].



Figure AE.5.2.1-1: Continued optimized media routing procedure

The steps in the call flow are as follows:

1. A media path in both directions is established between UEs. IMS AGWs on satellite forward voice/video media via ULCL and L-PSA on satellite between the UEs.

2. P-CSCF receives the early notification of the satellite user plane management events associated with UE-Satellite-UE communication media traffic from PCF as defined in clause 4.3.6.3 of TS 23.502 [94]. This early notification includes satellite ID of a target satellite that has gNB to which the UE gets connected, and an indication being set "EARLY", indicating that 5GC is prepared to change the user plane path for optimized media routing to the one through this target satellite.

3. P-CSCF determines that optimized media routing continues to be possible based on the satellite ID received in step 2 for the originating network and the satellite ID stored for the terminating network. P-CSCF determines to continue activating optimized media routing.

NOTE 3: How P-CSCF uses the satellite IDs to determine whether the two satellites are connected and whether optimized media routing is possible is up to implementation.

 If P-CSCF determines that optimized media routing cannot continue, P-CSCF follows the ground fallback procedure as defined in clause AE.5.2.2 for subsequent steps.

4. P-CSCF requests IMS AGW on the target satellite to configure the IP address allocated in UE, which P-CSCF has stored, to be used by the IMS AGW on the target satellite as the destination of media traffic towards the UE and to reserve an IP address in the IMS AGW on the target satellite to be used by the UE as the destination of media traffic. In addition, the P-CSCF requests the IMS AGW on the target satellite to configure context information other than IP addresses of the connection point towards the UE based on the corresponding context in the IMS AGW on the source satellite. This step 4 is performed according to clause 8.2 of TS 23.334 [74].

5. P-CSCF requests IMS AGW on the target satellite to configure the IP address allocated in IMS AGW on the remote satellite in the terminating network, which P-CSCF has stored, to be used by the IMS AGW on the target satellite as the destination of media traffic towards the terminating network and to reserve an IP address in the IMS AGW on the target satellite to be used by the IMS AGW on the remote satellite in the terminating network as the destination of media traffic towards the originating network. In addition, the P-CSCF requests the IMS AGW on the target satellite to configure context information other than IP addresses of the connection point towards the terminating network based on the corresponding context in the IMS AGW on the source satellite. This step 5 is performed according to clause 8.2 of TS 23.334 [74].

NOTE 4: It is assumed in general that the newly selected IMS AGW (i.e., IMS AGW on the target satellite) allows voice/video media to flow immediately after the reservation and configuration are completed (e.g., without waiting for the response from the remote end if the reservation and configuration are made triggered by SIP re-INVITE).

6. P-CSCF replies to PCF by invoking Npcf\_PolicyAuthorization\_Update service operation as defined in clause 4.3.6.3 of TS 23.502 [94] to the early notification received in step 2. The Npcf\_PolicyAuthorization\_Update request is a positive acknowledgement of notifications about UP path management events indicating that the change of the user plane paths for optimized media routing to the one through the target satellite should be performed. This request also includes the IP address allocated in IMS AGW on the target satellite to be used by UE as the destination of media traffic and optional N6 traffic routing information associated with target DNAI. SMF in 5GC establishes UL CL/BP and L-PSA on the target satellite, with the UL CL/BP configured with traffic filters containing this IP address to route the IMS media towards the L-PSA, according to clause 4.3.5.7 of TS 23.502 [94]. If N6 traffic routing information associated with target DNAI is received, SMF also configures the N6 traffic routing information on the L-PSA.

7. P-CSCF updates via PCF the packet filter list of the QoS rule in UE for media traffic to additionally contain the IP address allocated in IMS AGW on the target satellite to be used by UE as the destination of media traffic according to clause 4.3.3.2 of TS 23.502 [94].

8. P-CSCF receives the late notification of the satellite user plane management events associated with UE-Satellite-UE communication media traffic from PCF as defined in clause 4.3.6.3 of TS 23.502 [94]. This late notification contains an indication being set "LATE" that indicates that 5GC has established the user plane path for optimized media routing through the target satellite.

NOTE 5: The UL CL/BP and L-PSA on the source satellite are retained as long as active traffic exists over the N9 forwarding tunnel as described in clause 4.3.5.7 of TS 23.502 [94].

9. P-CSCF sends a SIP MESSAGE to IMS AS to request it to send SIP re-INVITE to the terminating network (i.e. step 10) and then towards the UE in the originating network after receiving the SDP answer from the terminating network (i.e. step 16). This SIP message contains the IP address allocated in IMS AGW on the target satellite to be used by the terminating network as the destination of media traffic. This SIP message also contains the satellite ID of the target satellite.

10. IMS AS sends SIP re-INVITE to the terminating network. This SIP re-INVITE contains an SDP offer that has the IP address allocated in IMS AGW on the target satellite to be used by the terminating network as the destination of media traffic. This SIP re-INVITE also contains a SIP header for conveying the satellite ID of the target satellite.

The following steps 11-15 are performed in the terminating network.

11. P-CSCF requests IMS AGW on satellite to configure the IP address received in step 10 to be used by the IMS AGW on satellite as the destination of media traffic towards the originating network. This step 11 is performed so far according to clause 8.4 of TS 23.334 [74]. In addition, P-CSCF stores the satellite ID of the target satellite in the originating network for future use.

NOTE 6: RTP/RTCP is not symmetric between step 11 and step 17.

12. The media path from the originating network to the terminating network remains the same. The media path from the terminating network to the originating network is via UL CL/BP, L-PSA, and IMS AGW on the remote satellite in the terminating network and further via IMS AGW, L-PSA, and UL CL/BP on the target satellite in the originating network.

13. P-CSCF sends SIP re-INVITE containing an SDP offer to UE.

14. UE sends SIP 200 OK containing an SDP answer to P-CSCF.

15. P-CSCF sends SIP 200 OK to the originating network. This SIP 200 OK also contains a SIP header for conveying the satellite ID of the satellite in the terminating network and an SDP answer. The satellite ID is the same as the one sent before the satellite change in the originating network.

The following steps 16-22 are performed in the originating network.

16. IMS AS sends SIP re-INVITE to P-CSCF. This SIP re-INVITE also contains a SIP header for conveying the satellite ID of the satellite in the terminating network and an SDP offer.

17. P-CSCF sends SIP re-INVITE to UE. This SIP re-INVITE contains an SDP offer that has the IP address allocated in IMS AGW on the target satellite to be used by UE as the destination of media traffic.

18. The media path in both directions is via ULCL, L-PSA, and IMS AGW on the target satellite in the originating network and UL CL/BP, L-PSA, and IMS AGW on the remote satellite in the terminating network.

19. UE sends SIP 200 OK containing an SDP answer to P-CSCF.

20. P-CSCF sends SIP 200 OK containing an SDP answer to IMS AS.

21. SMF in 5GC releases UL CL/BP and L-PSA on the source satellite according to steps 11 and 12 in clause 4.3.5.7 of TS 23.502 [94].

NOTE 7: The SMF releases the UL CL/BP and L-PSA on satellite after detecting no active traffic over the N9 forwarding tunnel as described in step 10 of clause 4.3.5.7 of TS 23.502 [94].

22. P-CSCF releases IMS AGW on the source satellite sometime after receiving SIP 200 OK in step 19. This step 22 is performed according to clause 8.5 of TS 23.334 [74].

---Start of the 2nd Change---

### AE.5.2.2 Ground fallback procedure

Figure AE.5.2.2-1 depicts a signalling flow diagram for the case where optimized media routing is abandoned and routing with the media transiting through the ground segment is selected after change of satellites serving a UE. The procedure is written in such a way that change of satellite occurs in the originating network for the purpose of the procedure, while change of satellite can occur in the terminating network as well.

NOTE 1: IMS entities not relevant for the procedure are omitted below for brevity of the description.

NOTE 2: In this Release of the specification, the originating network and the terminating network are the same PLMN.

Use of the N5 interface between IMS and 5GC is assumed.

Based on the procedure described in clause AE.5.1, P-CSCF is expected to subscribe to 5GC for the early and the late notification of the satellite user plane management events associated with UE-Satellite-UE communication media traffic as specified in clause 5.6.7 of TS 23.501 [93] and clause 4.3.6.3 of TS 23.502 [94].



Figure AE.5.2.2-1: Ground fallback procedure

The steps in the call flow are as follows:

1. Step 1 of clause AE.5.2.1 applies.

2. P-CSCF receives the early notification of the satellite user plane management events associated with UE-Satellite-UE communication media traffic from PCF as defined in clause 4.3.6.3 of TS 23.502 [94]. This early notification includes an indication being set "EARLY". This early notification may contain satellite ID of a target satellite that has gNB to which the UE gets connected, which indicates that 5GC is prepared to change the user plane path for optimized media routing to the one through this target satellite.

3. P-CSCF determines that optimized media routing cannot continue if there is no target satellite ID included in the early notification as received in step 2, or the two satellites identified by the satellite ID received in step 2 for the originating network and the satellite ID stored for the terminating network have no ISLs. The P-CSCF determines to activate ground fallback routing.

NOTE 3: How P-CSCF uses the satellite IDs to determine whether the two satellites are connected and whether optimized media routing is possible is up to implementation.

4. P-CSCF requests IMS AGW on ground to configure the IP address allocated in UE, which the P-CSCF has stored, to be used by the IMS AGW on ground as the destination of media traffic towards the UE and to reserve an IP address in the IMS AGW on ground to be used by the UE as the destination of media traffic. In addition, the P-CSCF requests the IMS AGW on ground to configure context information other than IP addresses of the connection point towards the UE based on the corresponding context in the IMS AGW on satellite. This step 4 is performed according to clause 8.2 of TS 23.334 [74].

5. P-CSCF requests IMS AGW on ground to reserve an IP address in the IMS AGW on ground to be used by the terminating network as the destination of media traffic towards the originating network. In addition, the P-CSCF requests the IMS AGW on ground to configure context information other than IP addresses of the connection point towards the terminating network based on the corresponding context in the IMS AGW on satellite. This step 5 is performed according to clause 8.2 of TS 23.334 [74].

6. P-CSCF replies to PCF by invoking Npcf\_PolicyAuthorization\_Update service operation as defined in clause 4.3.6.3 of TS 23.502 [94] to the early notification received in step 2. The Npcf\_PolicyAuthorization\_Update request indicates that the change of the user plane paths for the continuation of optimized media routing should not be performed. P-CSCF also sends to PCF the IP address allocated in IMS AGW on ground to be used by UE as the destination of media traffic, so that 5GC updates the packet filter list of the QoS rule in the UE for media traffic to additionally contain this IP address according to clause 4.3.3.2 of TS 23.502 [94].

7. P-CSCF sends a SIP MESSAGE to IMS AS to request it to send SIP re-INVITE to the terminating network (i.e. step 8) and then towards the UE in the originating network after receiving the SDP answer from the terminating network (i.e. step 18). This SIP message contains the IP address allocated in IMS AGW on ground to be used by the terminating network as the destination of media traffic. This SIP message does not contain any satellite ID.

8. IMS AS sends SIP re-INVITE to the terminating network. This SIP re-INVITE contains an SDP offer that has the IP address allocated in IMS AGW on ground to be used by the terminating network as the destination of media traffic. This SIP re-INVITE does not contain any satellite ID.

The following steps 9-16 are performed in the terminating network.

9. P-CSCF receives the SIP re-INVITE.

10. P-CSCF requests IMS AGW on ground to configure the IP address allocated in UE, which the P-CSCF has stored, to be used by the IMS AGW on ground as the destination of media traffic towards the UE and to reserve an IP address in the IMS AGW on ground to be used by the UE as the destination of media traffic. In addition, the P-CSCF requests the IMS AGW on ground to configure context information other than IP addresses of the connection point towards the UE based on the corresponding context in the IMS AGW on satellite. This step 10 is performed according to clause 8.2 of TS 23.334 [74].

11. P-CSCF requests IMS AGW on ground to configure the IP address received in step 9 to be used by the IMS AGW on ground as the destination of media traffic towards the originating network and to reserve an IP address in the IMS AGW on ground to be used by the originating network as the destination of media traffic towards the terminating network. In addition, the P-CSCF requests the IMS AGW on ground to configure context information other than IP addresses of the connection point towards the originating network based on the corresponding context in the IMS AGW on satellite. This step 11 is performed according to clause 8.2 of TS 23.334 [74].

NOTE 4: It is assumed in general that the newly selected IMS AGW (i.e., IMS AGW on ground) allows voice/video media to flow immediately after the reservation and configuration are completed (e.g., without waiting for the response from the remote end if the reservation and configuration are made triggered by SIP re-INVITE).

12. P-CSCF sends to PCF the IP address allocated in IMS AGW on ground to be used by UE as the destination of media traffic, so that 5GC updates the packet filter list of the QoS rule in UE for media traffic to additionally contain this IP address according to clause 4.3.3.2 of TS 23.502 [94].

13. P-CSCF sends SIP re-INVITE to UE. This SIP re-INVITE contains an SDP offer that has the IP address allocated in IMS AGW on ground to be used by UE as the destination of media traffic.

NOTE 5: RTP/RTCP is not symmetric between step 13 and step 20.

14. The media path from the originating network to the terminating network remains the same. The media path from the terminating network to the originating network is via UL CL on satellite, PSA on ground, IMS AGW on ground in the terminating network and further via IMS AGW on ground, PSA on ground, and UL CL on satellite in the originating network.

15. UE sends SIP 200 OK containing an SDP answer to P-CSCF. P-CSCF sets an implementation-specific timer for releasing IMS AGW on satellite that expires sometime after UE in the originating network receives SIP re-INVITE in step 20.

16. P-CSCF sends SIP 200 OK to the originating network. This SIP 200 OK contains an SDP answer that has the IP address allocated in IMS AGW on ground to be used by the originating network as the destination of media traffic towards the terminating network. This SIP 200 OK does not contain any satellite ID.

The following steps 17-23 are performed in the originating network.

17. IMS AS receives the SIP 200 OK.

18. IMS AS sends SIP re-INVITE to P-CSCF. This SIP re-INVITE contains an SDP offer that has the IP address allocated in IMS AGW on ground in the terminating network to be used by the originating network as the destination of media traffic towards the terminating network. This SIP re-INVITE does not contain any satellite ID.

19. P-CSCF requests IMS AGW on ground to configure the IP address received in step 18 to be used by the IMS AGW on ground as the destination of media traffic towards the terminating network. This step 19 is performed according to clause 8.4 of TS 23.334 [74].

20. P-CSCF sends SIP re-INVITE to UE. This SIP re-INVITE contains an SDP offer that has the IP address allocated in IMS AGW on ground in the originating network to be used by UE as the destination of media traffic.

21. The media path in both directions is via UL CLs on satellite, PSAs on ground, and IMS AGWs on ground.

22. UE sends SIP 200 OK containing an SDP answer to P-CSCF.

23. P-CSCF sends SIP 200 OK containing an SDP answer to IMS AS. This SIP 200 OK does not contain any satellite ID.

24. Both in the originating network and in the terminating network, SMF in 5GC releases UL CL and L-PSA on satellite according to steps 11 and 12 in clause 4.3.5.7 of TS 23.502 [94].

NOTE 6: The SMF releases the UL CL and L-PSA on satellite after detecting no active traffic over the N9 forwarding tunnel as described in step 10 of clause 4.3.5.7 of TS 23.502 [94].

25. P-CSCF in the originating network releases IMS AGW on satellite in the originating network sometime after receiving SIP 200 OK in step 22. P-CSCF in the terminating network releases IMS AGW on satellite in the terminating network after the timer being set in step 15 expires. This step 25 is performed according to clause 8.5 of TS 23.334 [74].

26. The media path in both directions is via PSAs on ground and IMS AGWs on ground.

---End of the Change---