**3GPP TSG-CT WG1 Meeting #133bis-eC1-220027**

**E-meeting, 17-21 January 2022 (was C1-214078)**

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| *CR-Form-v12.1* |
| **CHANGE REQUEST** |
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|  | **23.122** | **CR** | **0701** | **rev** | **3** | **Current version:** | **17.5.0** |  |
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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 | **X** | Radio Access Network |  | Core Network | **X** |

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| ***Title:***  | Tsor-cm timer handling in case of IRAT transitions  |
|  |  |
| ***Source to WG:*** | Apple |
| ***Source to TSG:*** | C1 |
|  |  |
| ***Work item code:*** | eCPSOR\_CON |  | ***Date:*** | 2022-01-17 |
|  |  |  |  |  |
| ***Category:*** | **F** |  | ***Release:*** | Rel-17 |
|  | *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-15 (Release 15)Rel-16 (Release 16)Rel-17 (Release 17)Rel-18 (Release 18)* |
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| ***Reason for change:*** | The current defintions in C.4.2 do not cover the case, that the connection is handed over to LTE and subsequently even to legacy RATs. According to the LS from SA1 in S1-214213, there is no service requirement to continue the use of the *timing control information* (received in the SOR information) after intersystem change. In consequence once a IRAT transition from NG-RAN to any other RAT happens, the running Tsor-cm timers shall be stopped without triggering any actions. |
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| ***Summary of change:*** | It is clarified, that in case of a IRAT transition from NG-RAN to any other RAT, any ongoing SOR-CMCI specific actions are aborted, i.e. the SOR procedure is terminated and the UE shall stop applying SOR-CMCI and stop all running Tsor-cm timers without triggering any further actions.  |
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| ***Consequences if not approved:*** | The UE behaviour in case of a IRAT transition to legacy RATs during a ongoing SOR-CMCI procedure is undefined. |
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| ***Clauses affected:*** | C.1.1; C.4.2 |
|  |  |
|  | **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 ...  |
|  |  |
| ***Other comments:*** |  |
|  |  |
| ***This CR's revision history:*** |  |

*\*\*\* first change \*\*\**

### C.1.1 Steering of roaming over the control plane in a PLMN

The purpose of the control plane solution for steering of roaming in 5GS procedure in a PLMN is to allow the HPLMN to update the "Operator Controlled PLMN Selector with Access Technology" list in the UE by providing the HPLMN protected list of preferred PLMN/access technology combinations or a secured packet via NAS signalling. If the selected PLMN is a VPLMN, the HPLMN can provide the steering of roaming information to the UE using the control plane mechanism during and after registration. If the selected PLMN is the HPLMN, the HPLMN can provide the steering of roaming information to the UE using the control plane mechanism after registration only. The HPLMN updates the "Operator Controlled PLMN Selector with Access Technology" based on the operator policies, which can be based on the registered VPLMN, the location of the UE, etc.

Editor's note (WI eNPN, CR#0790): Whether the UE can receive the SOR-SNPN-SI when registering or registered to a PLMN, and whether the UE can receive the list of preferred PLMN/access technology combinations together with the SOR-SNPN-SI, are FFS.

The HPLMN can configure their subscribed UE's USIM to indicate that the UE is expected to receive the steering of roaming information due to initial registration in 5GS in a VPLMN. At the same time the HPLMN will mark the UE is expected to receive the steering of roaming information due to initial 5GS registration in a VPLMN, in the subscription information in the UDM. In this case, it is mandatory for the HPLMN to provide the steering of roaming information to the UE during initial registration in a VPLMN. Otherwise if such configuration is not provided in the USIM, it is optional for the HPLMN to provide the steering of roaming information to the UE during initial registration (based on operator policy). The HPLMN can provide the steering of roaming information to the UE during the registration procedure for mobility registration update and initial registration procedure for emergency services. In addition, the HPLMN can request the UE to provide an acknowledgement of successful reception of the steering of roaming information.

NOTE 1: In annex C of this specification, the User Data Repository (UDR) is considered as part of the UDM.

As the HPLMN needs to consider certain criteria including the number of customers distributed through multiple VPLMNs in the same country or region, the list of the preferred PLMN/access technology combinations is not necessarily the same at all times and for all users. The list of the preferred PLMN/access technology combinations needs to be dynamically generated, e.g. generated on demand, by a dedicated steering of roaming application function (SOR-AF) providing operator specific data analytics solutions.

NOTE 2: The functional description of this dedicated application function (SOR-AF) is out of scope of 3GPP.

The steering of roaming connected mode control information (SOR-CMCI) enables the HPLMN to control the timing of a UE in 5GS connected mode to move to idle mode to perform the steering of roaming. If the UE selects a cell of any access technology other than NG-RAN, the SOR procedure is terminated, see clause C.4.2. The UE shall support the SOR-CMCI. The support and use of SOR-CMCI by the HPLMN is based on the HPLMN's operator policy.

The following requirements are applicable for the SOR-CMCI:

- The HPLMN may configure SOR-CMCI in the UE and may also send SOR-CMCI over N1 NAS signalling. The SOR-CMCI received over N1 NAS signalling has precedence over the SOR-CMCI configured in the UE.

NOTE 3: Based on HPLMN policy, while setting the SOR-CMCI the HPLMN can take into consideration the user preference for the service(s) not to be interrupted due to SOR (e.g. MMTEL voice call, MMTEL video call, HPLMN defined services, among others). The user can communicate its preference for the service(s) not to be interrupted due to SOR to the HPLMN utilizing non-standard operator-specific mechanisms, e.g. web-based.

- The UE shall indicate ME's support for SOR-CMCI to the HPLMN.

NOTE 4: The HPLMN has the knowledge of the USIM's capabilities in supporting SOR-CMCI.

- While performing SOR, the UE shall consider the list of preferred PLMN/access technology combinations or secured packet received in the SOR information together with the available SOR-CMCI.

- The HPLMN may provision the SOR-CMCI in the UE over N1 NAS signalling. The UE shall store the configured SOR-CMCI in the non-volatile memory of the ME or in the USIM as described in clause C.4.

In order to support various deployment scenarios, the UDM may support:

- obtaining a list of preferred PLMN/access technology combinations, and SOR-CMCI, if any (if supported by the UDM and required by the HPLMN), or a secured packet which is or becomes available in the UDM (i.e. retrieved from the UDR);

NOTE 5: A secured packet can be made available at the UDR via implementation specific means. In this case the implementation specific means are required to ensure that the secured packet satisfies the "Replay detection and Sequence Integrity counter" (see ETSI TS 102 225 [73]) every time it is sent out from the HPLMN to the UE.

- obtaining a list of preferred PLMN/access technology combinations and SOR-CMCI, if any (if supported by the UDM and required by the HPLMN), or a secured packet from the SOR-AF; or

- both of the above.

The HPLMN policy for the SOR-AF invocation can be present in the UDM only if the UDM supports obtaining a list of preferred PLMN/access technology combinations and SOR-CMCI, if any, or a secured packet from the SOR-AF.

The UDM discards any list of preferred PLMN/access technology combinations, SOR-CMCI, if any, or any secured packet obtained from the SOR-AF or which is or becomes available in the UDM (i.e. retrieved from the UDR), either during registration (as specified in annex C.2) or after registration (as specified in annex C.3 and C.4.3), when the UDM cannot successfully forward the SOR information to the AMF (e.g. in case the UDM receives the response from the SOR-AF with the list of preferred PLMN/access technology combinations, the SOR-CMCI, if any, or the secured packet after the expiration of the operator specific timer, or if there is no AMF registered for the UE).

The UE maintains a list of "PLMNs where registration was aborted due to SOR". If the UE receives steering of roaming information in the REGISTRATION ACCEPT or DL NAS TRANSPORT message and the security check to verify that the steering of roaming information is provided by HPLMN is successful, the UE shall remove the current selected PLMN from the list of "PLMNs where registration was aborted due to SOR". The UE shall delete the list of "PLMNs where registration was aborted due to SOR" when the MS is switched off, the USIM is removed or after a UE implementation dependent time.

If:

- the UE's USIM is configured to indicate that the UE shall expect to receive the steering of roaming information during initial registration procedure but did not receive it or security check on the steering of roaming information fails;

- the current chosen VPLMN is not contained in the list of "PLMNs where registration was aborted due to SOR";

- the current chosen VPLMN is not part of "User Controlled PLMN Selector with Access Technology" list; and

- the UE is not in manual mode of operation;

then the UE will perform PLMN selection with the current VPLMN considered as lowest priority.

It is mandatory for the VPLMN to transparently forward to the UE the steering of roaming information received from HPLMN and to transparently forward to the HPLMN the acknowledgement of successful reception of the steering of roaming information received from UE, both while the UE is trying to register onto the VPLMN as described in clause C.2, and after the UE has registered onto the VPLMN as described in clause C.3 and C.4.3.

If the last received steering of roaming information contains the list of preferred PLMN/access technology combinations then the ME shall not delete the "Operator Controlled PLMN Selector with Access Technology" list stored in the ME when the UE is switched off.

The "Operator Controlled PLMN Selector with Access Technology" list shall be stored in the ME together with the SUPI from the USIM. The ME shall delete the "Operator Controlled PLMN Selector with Access Technology" list stored in the ME when a new USIM is inserted.

The procedure in this annex for steering of UE in VPLMN can be initiated by the network while the UE is trying to register onto the VPLMN as described in clause C.2, or after the UE has registered onto the HPLMN or the VPLMN as described in clause C.3 and C.4.3.

*\*\*\* next change \*\*\**

### C.4.2 Applying SOR-CMCI in the UE

During SOR procedure and while applying SOR-CMCI, the UE shall determine the time to release the PDU session(s) or the services as follows:

- If the UE encounters SOR security check not successful on the received steering of roaming information, and a matching criterion "SOR security check not successful" is included in the SOR-CMCI stored in the non-volatile memory of the ME, then the UE shall:

- if the timer value is not zero, start an associated Tsor-cm timer with the value included in the SOR-CMCI;

- stop all other running Tsor-cm timers, if any; and

- not start any new Tsor-cm timer while Tsor-cm timer associated with "SOR security check not successful" criterion is running;

- If one or more SOR-CMCI rules are included in SOR-CMCI, where for each criterion:

a) DNN of the PDU session:

 the UE shall check whether it has a PDU session with a DNN matching to the DNN included in SOR-CMCI, and if any, the UE shall, if the timer value is not zero, start an associated Tsor-cm timer with the value included in the SOR-CMCI;

b) S-NSSAI SST of the PDU session:

 the UE shall check whether it has a PDU session with a S-NSSAI SST matching the S-NSSAI SST included in SOR-CMCI, and if any, the UE shall, if the timer value is not zero, start an associated Tsor-cm timer with the value included in the SOR-CMCI;

b1) S-NSSAI SST and SD of the PDU session:

 the UE shall check whether it has a PDU session with a S-NSSAI SST and SD matching the S-NSSAI SST and SD included in SOR-CMCI, and if any, the UE shall, if the timer value is not zero, start an associated Tsor-cm timer with the value included in the SOR-CMCI;

c) IMS registration related signalling:

 the UE shall check whether IMS registration related signalling is ongoing as specified in 3GPP TS 24.501 [64], and if it is ongoing, the UE shall, if the timer value is not zero, start an associated Tsor-cm timer with the value included in the SOR-CMCI;

d) MMTEL voice call:

 the UE shall check whether MMTEL voice call is ongoing as specified in 3GPP TS 24.501 [64], and if it is ongoing, the UE shall, if the timer value is not zero, start an associated Tsor-cm timer with the value included in the SOR-CMCI;

e) MMTEL video call:

 the UE shall check whether MMTEL video call is ongoing as specified in 3GPP TS 24.501 [64], and if it is ongoing, the UE shall, if the timer value is not zero, start an associated Tsor-cm timer with the value included in the SOR-CMCI;

f) SMS over NAS or SMSoIP:

 the UE shall check whether SMS over NAS or SMSoIP services is ongoing as specified in TS 24.501 [64], and if it is ongoing, the UE shall, if the timer value is not zero, start an associated Tsor-cm timer with the value included in the SOR-CMCI; or

g) match all:

 the UE shall check whether there are any PDU sessions or services for which there is no matching criterion in a) to f) above. If such PDU session or service exists, then for each of these PDU sessions or services, the UE shall, if the timer value is not zero, start an associated timer Tsor-cm with the value included in the SOR-CMCI.

If the SOR-CMCI is available, and:

- the SOR-CMCI used is in the USIM, contains no SOR-CMCI rule;

- there are one or more SOR-CMCI rules but there is no criterion matched with any ongoing PDU session or service; or

- there are one or more SOR-CMCI rules and there is one or more criteria matched with an ongoing PDU session or service, but the highest Tsor-cm timer value associated with the matched criteria is equal to zero;

then there is no Tsor-cm timer started for any PDU session or service.

While one or more Tsor-cm timers are running, the UE shall check the newly established PDU session or service for a matching criterion in the SOR-CMCI:

- If a matching criterion is found and the applicable Tsor-cm timer indicated the value "infinity" then the UE shall start the Tsor-cm timer associated to the newly established PDU session or service with the value set to infinity; or

- For all other cases, if a matching criterion is found and the timer value is not zero then the UE shall start the Tsor-cm timer associated to the newly established PDU session or service with the value included in the SOR-CMCI, with the exception that if the value of the Tsor-cm timer included in the SOR-CMCI exceeds the highest value among the current values of all running Tsor-cm timers, then the value of the Tsor-cm timer for the newly established PDU session or service shall be set to the highest value among the current values of all running Tsor-cm timers.

NOTE 1: For newly established PDU session or service as described above, the timer is set irrespective of whether other ongoing PDU sessions or services that match the same criteria exist and for which corresponding Tsor-cm timers are running.

NOTE 2: NAS 5GMM layer will receive an explicit indication from the upper layers that a service is started or stopped. When a service is started, it is handled as a new service in the procedures described in this clause.

NOTE 3: While one or more Tsor-cm timers are running, the UE can trigger any 5GSM procedure or start new services.

While one or more Tsor-cm timers are running, upon receiving a new SOR-CMCI as described in annex C.4.3, the UE shall check if there is a matching criterion found for any ongoing PDU session or service in the new SOR-CMCI:

-- if a matching criterion is found and the value of Tsor-cm timer in the new SOR-CMCI indicates the value "infinity", then:

a) if the Tsor-cm timer associated to the PDU session or service is not running, then the UE shall start the Tsor-cm timer associated to the PDU session or service with the value set to infinity; or

b) if the Tsor-cm timer associated to the PDU session or service is already running, then the UE shall set the value of the Tsor-cm timer associated to the PDU session or service to infinity without stopping and restarting the timer;

- if a matching criterion is found and the value of Tsor-cm timer in the new SOR-CMCI is other than infinity and is smaller than the current value of the running Tsor-cm timer for the associated PDU session or service, then the Tsor-cm timer value for the associated PDU session or service shall be replaced with the value in the new SOR-CMCI without stopping and restarting the timer; or

- for all other cases, the running Tsor-cm timers for the associated PDU sessions or services are kept unchanged.

The Tsor-cm timer shall be stopped when the associated PDU session is released or the associated service is stopped.

If the UE, while one or more Tsor-cm timers are running:

a) enters idle mode not due to lower layer failure (see 3GPP TS 24.501 [64]);

b) is not able to successfully recover the N1 NAS signalling connection (see 3GPP TS 24.501 [64]); or

c) enters 5GMM-CONNECTED mode with RRC inactive indication (see 3GPP TS 24.501 [64]);

then the UE shall stop the timer(s). In these cases, if:

a) the UE has a list of available and allowable PLMNs or SNPNs in the area and based on this list or any other implementation specific means, the UE determines that there is a higher priority PLMN or SNPN than the selected VPLMN or non-subscribed SNPN; or

b) the UE does not have a list of available and allowable PLMNs or SNPNs in the area and is unable to determine whether there is a higher priority PLMN or SNPN than the selected VPLMN or non-subscribed SNPN using any other implementation specific means;

then the UE shall attempt to obtain service on a higher priority PLMN or SNPN as specified in clause 4.4.3.3 by acting as if timer T that controls periodic attempts has expired or as specified in clause 4.9.3.

NOTE 4: When the UE enters idle mode due to lower layer failure while one or more Tsor-cm timers are running, then the UE does not stop Tsor-cm timer(s) as recovery of NAS signalling connection is possible (see 3GPP TS 24.501 [64]).

When the UE determines that no Tsor-cm timer is started for any PDU session or service, the last running Tsor-cm timer is stopped due to release of the associated PDU sessions or stop of the associated services, or the last running Tsor-cm timer expires, if:

i) the UE has a list of available and allowable PLMNs or SNPNs in the area and based on this list or any other implementation specific means, the UE determines that there is a higher priority PLMN or SNPN than the selected VPLMN or non-subscribed SNPN; or

ii) the UE does not have a list of available and allowable PLMNs or SNPNs in the area and is unable to determine whether there is a higher priority PLMN or SNPN than the selected VPLMN or non-subscribed SNPNusing any other implementation specific means;

then if the UE is in 5GMM-CONNECTED mode, the UE shall perform the deregistration procedure (see clause 4.2.2.3 of 3GPP TS 23.502 [63]) that releases all the established PDU sessions and services, if any, and once the UE enters idle mode it shall attempt to obtain service on a higher priority PLMN or SNPN as specified in clause 4.4.3.3 by acting as if timer T that controls periodic attempts has expired or as specified in clause 4.9.3.

NOTE 5: The list of available and allowable PLMNs or SNPNs in the area is implementation specific.

The UE which has an emergency PDU session, receives a request from the upper layers to establish an emergency PDU session or perform emergency services fallback, registers for emergency services, or is configured for high priority access in the selected PLMN or SNPN is not required to enter idle mode if the last running Tsor-cm timer for any PDU session or service stops or expires. In this case, the UE shall attempt to perform the PLMN or SNPN selection after the emergency PDU session or the high priority service is released and after the UE enters idle mode or 5GMM-CONNECTED mode with RRC inactive indication (see 3GPP TS 24.501 [64]).

If the UE selects a cell of any access technology other than NG-RAN, the ongoing SOR procedure is terminated and the UE shall stop applying SOR-CMCI and stop all running Tsor-cm timers without triggering any further actions.

NOTE 6: If the UE is served by any access technology other than NG-RAN the HPLMN can start a steering of roaming see clause 4.4.6.

*\*\*\* last change \*\*\**