**3GPP TSG- Meeting #**

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| *CR-Form-v12.2* |
| **CHANGE REQUEST** |
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|  |  | **CR** |  | **rev** |  | **Current version:** |  |  |
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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 |  |

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| ***Title:***  |  |
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| ***Source to WG:*** |  |
| ***Source to TSG:*** | S4 |
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| ***Work item code:*** |  |  | ***Date:*** |  |
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| ***Category:*** |  |  | ***Release:*** |  |
|  | *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:*** | The major part of Annex C as approved in S4-140477 was never included in TS 26.132. |
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| ***Summary of change:*** | Adding missing text for Annex C according to S4-140477. |
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| ***Consequences if not approved:*** | Text Annex in C remains incomplete, method for determining one-way delays of LTE radio network simulators not defined. |
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| ***Clauses affected:*** | Annex C |
|  |  |
|  | **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:*** | Corresponding CR to Rel-17 in S4-230315 |
|  |  |
| ***This CR's revision history:*** |  |

Annex C (informative):
Measurement method for determining the one-way radio delays of LTE radio network simulators

The method described in this Annex can be used to determine or verify the delay introduced by a LTE radio network simulator.

NOTE. There is an inherent uncertainty in the method due to the unknown delay of the modem delay (software stack in the modem). If this delay is known the measurement uncertainty can be reduced.

# C.1 Measurement setup



Figure C1: Measurement setup

The measurement setup consists of an IP reference gateway with USB access connected to an IP logger or a test system with integrated IP-logger, an arbitrary LTE mobile phone and the LTE radio network simulator under test. The LTE radio network simulator has to be equipped with an IP logger (either preinstalled or installed for the test setup). The mobile phone acts as modem and is connected to the reference gateway via USB (tethering mode). The mobile phone is further connected over the air interface to the LTE cell of the radio network simulator equipped with a LTE-compliant antenna. Within the radio network simulator, a loopback mode is used to mirror the incoming packets back via the modem to IP reference gateway.

An Ethernet connection via cable is established temporally in parallel between the IP reference gateway and the radio network simulator. This connection is used for synchronization tasks. On both devices, on the IP reference gateway and on the radio tester, in- and outgoing packets are logged via IP logging program.

# C.2 Test procedure

The following steps have to be performed in order to determine the radio network simulator LTE delay:

Step 1) Preparation for the synchronization of the IP loggers:

- The cable-based Ethernet connection is plugged in.

- Both IP loggers are started.

- A ping command is sent from the reference gateway GUI to the IP address of the radio tester. It must be ensured that this ping event is logged on the reference gateway as well as on the IP logger of the radio tester. The ping event is used to compensate clock offsets between the IP loggers at the end of the procedure. The ping roundtrip delay has to be noted. The roundtrip delay indicates the amount of delay to be added to the monitored RTP packets time stamps in send and receive, assuming that it can be symmetrically allocated to both directions.

- Now the cable-based Ethernet connection is disconnected and the USB tethering connection to the mobile phone is established.

Step 2) Measurement of the Loopback RTP Delay:

- IP logging is still active on the radio tester.

- The tethering device connected to the reference gateway is activated and routing is selected over the tethering device.

- The loopback mode is activated at the radio tester.

- An audio call is established from the reference gateway using AMR-NB, AMR-WB or EVS-SWB encoded RTP packets.

- The call is stopped after an appropriate amount of averaging time; IP logging is stopped.

- A possible clock offset between the two IP loggers can be corrected by synchronizing the logfiles based on the previously documented ping events to a common time base.

- The data collected by the two IP loggers are merged into a common table.

- Delays now can be calculated for each packet in sending and the receiving direction separately.

Step 3: Measuring the tethering delay:

- The device-dependant tethering delay of the modem needs to be determined separately in the following.

- An IMS-APN is created on the modem device and used for the measurement. QCI 5 (IMS signalling) and QCI 1 (voice data) should be established.

- A ping command is sent from the reference gateway to the IP address of the DHCP server of the tethering device. Half of the resulting round trip delay is used to estimate the tethering delay, again assuming a symmetrically distributed delay. It is assumed that voice data will be delayed in the same way, since the phone utilizes an IMS-APN. The connection should be verified by checking the entries in the system simulator, which should report that channels for QCI=5 (IMS signalling) and QCI=1 (voice data) were established.

Step 4) Correction of the measured results:

- Half of the ping roundtrip delay is added to send and receive direction.

- Half of the tethering delay is subtracted from send and receive direction.