TM500 LTE TDD MUE Test Mobile

Customer Release Notes

Release S4.0.0

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TM500 LTE Test Mobile Release Note

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1 INTRODUCTION

1.1 Purpose

This is the release note for 3GPP LTE TDD Multi-UE Release S4.0.0.

This release adds the following new functionality:

- TDD dual layer beamforming (Release 9, PDSCH tx mode 8)
- Slow Fading (AWGN) support in the Online Mobility Model
- CMAS support. See section 3.7.1.1.1.
- Radio Link Failure reports (UE Information procedure)

A description of the new functionality can be found in Section 2 and a list of the issues resolved in this release is in Section 4.

This release is compliant to 3GPP LTE Release 8 March'09 specifications. It is possible to enable up to Dec'10 compliance for both Release 8 and Release 9.

This release uses Dec '10 Rel-9 ASN.1, which is backwards compatible with the earlier versions.

1.2 Hardware support

This release supports TM500 LTE TDD MUE. This software requires the TM500 LTE MUE Platform C hardware (**5 DSP cards**).

This release provides support for all 3GPP bands and band 24/L, dependent on the RF module fitted. Some bands are only available on the Multi-band Radio Card.

1.3 Scope

This document describes available functionality plus known limitations.

1.4 Supporting Documents

All documentation for this release is contained within the installer, with the exception of the Customer Release Note, which is external.

The CRM documentation for this release is S4.0 47090/015 Issue 12, 15 December 2011

The MRM documentation for this release is 47090/108 Issue 8, 1 November 2011

The LTE System Overview documentation is 47000/055 Issue 4, 11 October 2010

The TMA documentation for this release is 46882/878 Issue 38, 11 November 2011

The Installation and Configuration Guide for this release is 46892/960 Issue 14

The Capacity Test Machine-To-Machine (M2M) Interface Reference Manual for this release is 4700/056 Issue 5, 8 September 2011

The PPPoE Manual for this release is 47090/113 Issue 1, 15 September 2011

1.5 Version display

It is important that the versions of hardware, firmware and software on the TM500 LTE are correctly matched. If the Versions of the CON, SIG and MOD are different, then please use the firmware update utility to update the firmware of the radio card.

```
C: GVER 0x00 Ok
 PPC-0:
  BSP: 2.0/y/R10
   APP: TM500 LTE VERSION:S4.0.0:REV1:PPC:S4.0.0
DSP-0:
   APP: TM500 LTE VERSION:S4.0.0:REV1:DSP:S4.0.0
   PCB: 0
  VHDL: 0x0057
DSP-1:
   APP: TM500 LTE VERSION:S4.0.0:REV1:DSP:S4.0.0
DSP-2:
   APP: TM500 LTE VERSION:S4.0.0:REV1:DSP:S4.0.0
DSP-3:
   APP: TM500 LTE VERSION:S4.0.0:REV1:DSP:S4.0.0
DSP-4:
   APP: TM500 LTE VERSION:S4.0.0:REV1:DSP:S4.0.0
   PCB: 0
  VHDL: 0x0057
DSP-5:
   APP: TM500 LTE VERSION:S4.0.0:REV1:DSP:S4.0.0
DSP-6:
   APP: TM500 LTE VERSION:S4.0.0:REV1:DSP:S4.0.0
DSP-7:
   APP: TM500 LTE VERSION:S4.0.0:REV1:DSP:S4.0.0
DSP-8:
   APP: TM500 LTE VERSION:S4.0.0:REV1:DSP:S4.0.0
   PCB: 0
  VHDL: 0x005C
DSP-9:
   APP: TM500 LTE VERSION:S4.0.0:REV1:DSP:S4.0.0
DSP-10:
   APP: TM500 LTE VERSION:S4.0.0:REV1:DSP:S4.0.0
DSP-11:
   APP: TM500 LTE VERSION:S4.0.0:REV1:DSP:S4.0.0
DSP-12:
   APP: TM500 LTE VERSION:S4.0.0:REV1:DSP:S4.0.0
DSP-13:
   APP: TM500 LTE VERSION:S4.0.0:REV1:DSP:S4.0.0
DSP-14:
   APP: TM500 LTE VERSION:S4.0.0:REV1:DSP:S4.0.0
DSP-15:
   APP: TM500 LTE VERSION:S4.0.0:REV1:DSP:S4.0.0
DSP-16:
   APP: TM500 LTE VERSION:S4.0.0:REV1:DSP:S4.0.0
   PCB: 0
  VHDL: 0x4003
DSP-17:
   APP: TM500 LTE VERSION:S4.0.0:REV1:DSP:S4.0.0
DSP-18:
   APP: TM500 LTE VERSION:S4.0.0:REV1:DSP:S4.0.0
DSP-19:
   APP: TM500 LTE VERSION:S4.0.0:REV1:DSP:S4.0.0
Version Label: LTE-MUE-C0309_TDD_5C_L1_S_04_00_00_REV02
 UMBRA-0
       API: 10.2.1  Product: 3
       APP: 1.0.122  Built: Nov  8 2011 16:52:16
       CON: 3.2.5  Build: 312
       SIG: 2.1.1  Build: 46
       MMC: 1.7
       Carrier:  Loc: <Hardware Specific>
       PCB: <Hardware Specific>
       SN: <Hardware Specific>
       BarCode: <Hardware Specific>
        MOD TX: 0.0.17  Build: 16
        MOD RX: 0.0.29  Build: 32
        Type: <Hardware Specific>
        PCB: <Hardware Specific>
        SN: <Hardware Specific>
        BarCode: <Hardware Specific>
```

2 RELEASE INFORMATION

2.1 Added functionality for this release

- TDD dual layer beamforming (Release 9, PDSCH tx mode 8, support of 20MHz of System BW)
- Slow Fading (AWGN) support in the Online Mobility Model
- CMAS support. See section 3.7.1.1.1
- Radio Link Failure reports (UE Information procedure)
- TMA:
    1) Double clicking on a Session in the Session Browser opens that Session's history
    2) Added a toolbar item in each Session's window to allow opening of the history in MS Explorer.
    3) Export of a Session History to a folder also opens MS Explorer in that folder.
- The list of the issues resolved in this release is in Section 4

2.2 Supported headline functionality

The supported headline functionality for this release is listed below:

- RRC 3GPP March 2009 compliance, with configurable compliance to June '09, Sept '09 and Dec '09 via RRC SETP commands. NAS Release 8 3GPP March 2009 compliance, with configurable compliance for Release 8/9 to June '09, Sept '09, Dec '09, Mar '10, June '10, Sept '10 and Dec'10 via NAS SETP commands. See section 3.2.2 for details. Note that the TM500 RRC is compatible with Release 9 Dec '10 ASN.1
- Number of simultaneous UEs supported: 32
- Support for NAS, PDCP and HARQ test modes
- Support for NAS, RRC, PDCP, RLC (TM/UM/AM), MAC, and L1 layers
- Support for PPPoE in RLC and PDCP modes
- Support for Ciphering and Integrity in NAS and PDCP modes – including support for the SNOW 3G and AES algorithms
- Robust Header Compression (RoHC) (licensed option).
- UE Category 2, 3 and 4
- 64QAM UL support (Category 5)
- Support for 1.4MHz, 3MHz, 5MHz, 10MHz, 15MHz and 20MHz bandwidth
- RF Frequency Range – 3GPP bands 38 and 40 (dependent on the RF module fitted)
- 2x2 MIMO
- DRX support
- Closed Loop MIMO
- Distributed VRB

- L1 support:
    - P-BCH
    - PDCCH
        - Support for DCI formats 0, 1, 1A, 1C, 2, 2A, 3 and 3A.
    - PDSCH
        - Transmission modes: 1, 2, 3, 4, & 7.
        - Transport channels: PCH, D-BCH, and DL-SCH.
    - PUSCH
        - Transport channels: UL-SCH.
        - PUSCH supports frequency hopping.
    - PUCCH
        - PUCCH formats 1, 1A, 1B, 2, 2A and 2B.
    - SRS is supported (including frequency hopping and in TDD special sub-frames).
    - PRACH
        - Sequential preamble transmission (that is 1 preamble at a time)
        - Concurrent PRACH transmission can be enabled with FORW MTE PhySetPrachCollisionMode.
        - PRACH path delay configuration is supported
    - Closed loop power control.
    - CQI override.
    - Closed loop HARQ:
        - Scripting DL-SCH ACK/NACK.
- Support for FF and PN data generators and evaluators in all supported modes.
- Support for retaining the RNTI value signalled in RACH message 2.
- Support for using the signalled timing adjust (TA) command.
- **ABOT**, **RBOT** and **RSET**.
  The commands **ABOT** and **RBOT** reboot the TM500 and permit recovery from a system assert without a power cycle.
  RSET performs a reset, and restores the TM500 to its initial power-on state; see the CRM for further details.
  Note that **RBOT** should always be used in NAS mode.
- TMA features supported:
    - Support for all TMA measurement groups except where stated in Section 3.
    - Most measurement groups are UE specific and are configurable to enable the UEs of interest to be logged; tabbed chart displays are provided for selecting the UEs to view.
    - TMA 'Protocol View'. This provides both compressed and detailed views of protocol messages in the form of a message sequence chart with RRC and NAS

message decoding. Two views are provided enabling side by side comparison of the messaging for multiple UEs.

- The TMA Test Manager has new features to simplify the creation of test cases for sets of UEs:
  - Ability to define a set of UEs (a “UE Group”) on which the subsequent test steps apply.
  - Test step property dialogs provide a per-UE multi-column editing facility to enable the settings for each UE to be conveniently entered and the per-UE settings to be compared.
- Incident Reporting. This is a new facility that automatically collects information from the TM500 in the event of a system problem. Optionally the information can be sent to Aeroflex for analysis and problem resolution.
- Support for beamforming via the Configure Beam Forming test step, located on the test step library under Common > System Control.
- TMA is supported on the Windows 7 operating system.

- Table driven CQI.
- MILENAGE support in simulated USIM.
- Closed Loop MIMO.
- Channel Modelling with Dynamic BLER.
- Multi-UE Handover.
- Machine to Machine (M2M) interface
- Support for IPv6 PDN connection to LTE core network (PPPoE data entity termination only at present), including full IPv6 packet filtering support.
  Only NAS mode is supported, but RLC and PDCP modes are provided in beta state.
  Network-allocated link local addressing is supported.
  IPv6 Auto Address Configuration and stateless DHCPv6 are provided in beta state.
- EDIP+
- TDD single layer beamforming (Release 8, PDSCH transmission mode 7)
- TDD dual layer beamforming (Release 9, PDSCH transmission mode 8)
- Inter-Frequency handover (any band to any band)
- IP Driver is supported in NAS mode.
- Support for CS Fallback (CSFB) simulation. A number of new commands and indications are added to support this feature. Refer to Appendix D of the Command Reference Manual for full details.
- Support for tracking Timing Adjust commands for a designated UE using the PhyConfigUlTiming command.
- RRC band override is provided by the command RrcAptOverrideBandSupport.
- MCI length field support. Refer to section 2.1.22 of the Command Reference Manual for details.

- RRC Connection Re-establishment test feature (beta). See CRM command RrcAptTriggerRrcReestablishmentReq.
- Dynamic Creation and deletion of UEs.
- Rel-9 IMS Emergency Call (Dec'10 baseline)
- Support for Multi-band Radio Module
- Normal and Extended Cyclic Prefix support
- TTI Bundling support - Note that UL subframe bundling is not currently supported for TDD configuration 0

3 NOTES

3.1 Layer 1 and Layer 2 Operational information

The following operational information is applicable:

IMPORTANT: For optimal decoding performance the input power to the test mobile must be kept below -25dBm.

- The TM500 implements the behaviour defined in 36.321/5.4.4 regarding initiating a Random Access Procedure if an SR is triggered but PUCCH resource for SR is not configured. By default this behaviour is enabled, but a SETP command is provided to disable this if required. This may be required when performing a handover as the SFN of the target cell, required to configure the PUCCH for SR, would not be available until the MIB has been read from the BCH of the target cell.

  SETP L2_MAC_DISABLE_SR_INIT_RACH_IF_SR_NOT_CFG N

  N = 0 (3GPP compliant behaviour) or 1 (do not RACH if SR not configured on PUCCH), default 0
- RF cables must be directly mapped between TM500 and the test peer, i.e. Rx1 to Tx1, and Rx2 to Tx2. This is a TM500 LTE MUE restriction
- PhySetTDDCfg must be used to configure TDD system in ALL modes (HARQ, MAC, RLC, PDCP, RRC, NAS…) prior to initial cell search. Note that this is a system configuration (i.e. MUE TDD it applies to all UEs) and should therefore only be used when configuring to the first UE
- Currently if a PHICH Resource (Ng) value other than 1/6th is required, all P-BCHs must be configured and activated prior to configuring any other channels. The PHICH Resource (Ng) value is configured via the PhyConfigPdcch command.
- Re-configuration of Cell Specific parameters is only supported if no channels are deleted.
- In general timing adjust (TA) commands sent by the eNB are not processed by TM500 but are just logged. An option is provided in the **PhyConfigUlTiming** command to use the first signalled TA, and apply it to all UEs. Refer to the Command Reference Manual for details. The default behaviour is to use the first signaled TA, and apply it to all UEs
- To update the radio firmware in the TM500, please note the following command:

  forw fum updateradio

  This command can only be issued when in “firmware update mode”.
  Please note that all the radio firmware is now contained in a single file (firmware.pkg) which must be located in the FW directory under the ftp_root/fw directory.
- The UL interference configured by the command PhyConfigUlInterference is applied only when an UL channel is configured and is only applied over the configured system bandwidth.
- UL interference, configurable in the range -37..-27 dBm/RB, is mandatory. The user must ensure that the transmission power is configured appropriately to achieve the expected SNR at the eNB:
  - For PUSCH transmissions the user (either via signalling in NAS mode or via the **PhyConfigPusch** (in HARQ mode) must ensure that the "Dynamic Scheduling Nominal PUSCH Power" is at a level adequate to the interference level (that is in the high range >-30 dbm / Rb (and higher for high MCs)).
    The PUSCH power can be further controlled via the 'PUSCH power offset' parameter added to the **PhyConfigUlPowerOffset** command.
    Note: the ‘PUSCH power offset’ parameter is an offset to the "Dynamic scheduling nominal PUSCH power (P0_nominal_PUSCH)", that is does not apply to MSG3.

The MSG 3 power offset is identical to the PRACH offset specified in the **PhyConfigUlPowerOffset** command.

- For PUCCH and PRACH transmissions the user can control the PUCCH and PRACH transmit power levels by "boosting" the corresponding Tx power level via the **PhyConfigUlPowerOffset** (note the default power offsets already boost the Tx power level for these two channels).

- Non-detect information in GetStats is only supported for the DL-SCH.
- In HARQ mode we only support configuration of 5 UL Data Entities
- The antennas to be used in TDD beamforming are selected using the PhyConfigBeamforming command. This is used to select the single RX antenna used for reception of port 5 transmissions in PDSCH transmission mode 7, and the selection of the antennas used for reception of port 7 and port 8 transmissions in PDSCH transmission mode 8.
- Codebook subset restriction is not supported.
- When re-configuring the DL-SCH in MAC or HARQ mode the following commands must be re-issued even if they do not contain any parameters that are being changed/re-configured. In HARQ mode these are: PhyConfigDlSch, PhyConfigDlSchCqi and HarqConfigDlSch. In MAC mode these are: PhyConfigDlSch, PhyConfigDlSchCqi and MacConfigDlSch.
- When configuring a PRACH, commands must also be sent to set up an UL-SCH, PUCCH, PDCCH, and DL-SCH.
- AFC and DL symbol timing tracking are performed using channel estimates from a single channel only (1st transmit antenna to 1st receive antenna).
- When configuring the Fixed Frame Evaluator or Pseudo Noise Evaluator for the BCH, the NumBitsToSkip parameter should be set to 0 and the NumBitsToCheck should be set to 7.
- The timing type in the Activate command must be set to “Immediate”.
- The test mobile provides in-sync or out-of-sync indications based on the DL RS SIR.
- The system capability command PHYGETSYSCAP is not supported.
- GETSTATS data is delayed by 100ms.
- Fixed frame generator and evaluator configuration must contain at least one byte.
- In general the order of script commands is not important. When an Activate command is issued the various layers are configured appropriately.
- Only values of 0, 1, or 4 are supported for the ‘DL Transport Channel Identifier’ parameter within the DeConfigTrCh command.
- Only values of 0, 1, 2, or 4 are supported for the ‘Transport Channel Type’ parameter within the PhyDeleteTrch command.
- Blind detection of the number of eNodeB transmit antennas is not supported and hence a non-zero value must always be provided for the optional parameter ‘Number of eNB transmit antennas' within the **PhyConfigPbch** command.
- REINIT is not supported.
- The maximum SDU size supported by the RLC is 2048 bytes.
- For high data rate operation a minimum SDU size of 150 bytes is recommended on the U plane, and in general the higher the data rate, the higher the SDU size should be.
  When using PPPoE the following data rates have been validated:
  - DL ~16000 PDCP SDUs (IP packets) per second at ~33mbps (SDU size of ~260bytes)
  - UL ~8500 PDCP SDUs (IP packets) per second at ~22mbps (SDU size of ~323bytes)

- In PDCP mode ciphering and integrity can be configured using the PDCPCONFIGSECURITY command.
- In PDCP and RLC modes the PPPoE data entity is now available using the DECONFIGPPPOEDEFAULTATTRIB and DECONFIGPPPOEDEDICATEDATTRIB commands.
- The PHYCONFIGRADIOLINKMONITORING command is not supported.
- The implementation of MAC CR379 does not support decoding of PDCCH grant for the C-RNTI during the RACH procedure, except at the contention resolution stage. An SR triggered contention based RACH can be initiated. This may have consequences for contention resolution, in this scenario, if CR379 is enabled.
  CR379 controlled by the SETP L2_MAC_ENABLE_CR379_R2_094167. See section 3.5.3 for details..
- TMA context sensitive help is not available for the new MUE measurement groups.
- In all TMA measurement groups downlink power measurements are not calibrated.
- In Measurement group DLL1L2CONTROL, the RB information is only logged if an UL transmission is performed.
- The pc may experience a virtual memory limit (2GB) exceedance resulting in possible TMA instability if all the measurement charts are repeatedly created and destroyed multiple times (approx. 1000+). The probability of exceedance could be reduced by selecting a reduced range of charts. This problem appears to be due to a Windows kernel limit (http://support.microsoft.com/default.aspx/kb/949755).
- Measurement group ULSCHTX does not log PUCCH only transmissions.
- If a PDSCH transport block is spuriously retransmitted (NDI not toggled after successful reception) this is logged as a NACK in the DLSCHRX and DLHARQ logging.
- If the TMA resets the TM500 by disconnecting and reconnecting in quick succession a spurious benign error message may be displayed: I: ERNO 0x00000000 0x00000001 0x00000000 Command timed out.
- RRC related annotations on the L1CELLHANDOVER chart will not appear unless the layer 3 status is selected to be log/charted and are not shown on replay in reverse.
- Within the TMA measurement group L1CELLHANDOVER it is not, at present, possible to view the information about which cell a particular UE is camped on and subsequently the real RSRP and RSRQ values. The measurement group should be used to view the modeled RSRP and RSRQ values for each UE only as well as notification as to when a UE has handed over.
  The camped cell information is available in a number of other measurement groups, such as DLL1L2CONTRL, DLSCHRX and ULSCHTX and the real RSRP and RSRQ values for each cell can be viewed in the L1CELLWATCH measurement
- In the Protocol log, theS32Q16RsrpIndBmpower value in L1_L0L1_CPHY_SCHR_INTRA_MEAS_SET_IND_CELL_INFO is a scaled value, and should be divided by 65536 to convert to a value in dBm.
- Protocol log files are generated per UE. Empty files are created for inactive UEs.
- Protocol log configuration: user-plane logging at the following four layers: PHY, MAC, RLC, PDCP, is mutually exclusive.
- In Analyse mode a single 1000 message buffer is used to show the results of the selected logging session. If high rate logging (L1 or L2) has been selected then L3 messages may not be visible.
- In the TMA, if the Layer 3 Status Display is shown when connected and the user then views logged data from a previous session while still connected, the TMA may not return to “Test Mode” when requested. The user should disconnect from the Test Mobile before viewing logged data for a previous session if the Layer 3 Status Display is shown on connection.

- The TMA is limited to logging 10 bearers/logical channels in the uplink and 11 bearers/logical channels in the downlink.
- The TMA Test Manager cannot generate a script for PDCP Mode that contains a D-BCH but no BCH.
- EDIP message latency improved by disabling Nagle.
- With immediate override commands (PhyCqiOverride, PhyTriggerMacCtrlBlock, PhyOverridePropLoss, UL-Power, DL/UL-Force Error, Dymanic BLER, etc) in NAS mode there is a possible race between the configuration activating and the current NAS configuration completing.

  This may cause the immediate override to not execute, the Symptom of this is that the one shot override will return the result “No Configuration changes found”.

  The command can be called again until a successful return code is returned.
- Support for IPv6 for U plane data in NAS mode. More details are provided in section 2.2.
- Note measurement gaps are not supported, the command PhyConfigMeasurementGaps will be rejected when issued. In NAS mode, a received measurement gap configuration will be ignored.
- Measured CQI for 1.4MHz will always report CQI of 15 with Rank 2, this is a limitation due to lack of noise estimation in 1.4MHz.

3.1.1 RoHC Operational information

- RoHC is a licensed option. If the license key for RoHC is not installed than attempting to configure RoHC will result in a command failure.
- All RoHC profiles in 36.323 are supported:

Profile Identifier	Usage:	Reference
0x0000	No compression	RFC 4995
0x0001	RTP/UDP/IP	RFC 3095, RFC4815
0x0002	UDP/IP	RFC 3095, RFC4815
0x0003	ESP/IP	RFC 3095, RFC4815
0x0004	IP	RFC 3843, RFC4815
0x0006	TCP/IP	RFC 4996
0x0101	RTP/UDP/IP	RFC 5225
0x0102	UDP/IP	RFC 5225
0x0103	ESP/IP	RFC 5225
0x0104	IP	RFC 5225

- The PDCPCONFIGSYSCAP command has an additional parameter ‘Supported ROHC Profiles’ enabling the supported profiles to be configured for reporting to the network in a UE Capability message in NAS mode.
- The PDCPCONFIGAB command has new choice parameter if ‘ROHC Configured’ is 1: ‘Max CID’ and ‘ROHC Profiles’,
- Non IP packets are discarded if routed through an access bearer configured for RoHC.
- PDCP throughput measurements are evaluated before compression/after decompression.

3.1.2 Layer 2 Spec Compliance.

Release 9 Dec 10 spec compliance is supported via the implementation of the following CRs:

- CR410 SR prohibit timer
- CR409 Clarification on monitoring of PDCCH : DRX optimisation
- CR407 SR prohibit mechanism for SPS : logicalChannel-SRmask

Notes:

CR409 support is enabled using "SETP L2_MAC_ENABLE_REL_9_CR409 1", and may also be used as optimisation with a Release 8 eNB.

CR407 support is enabled by using the optional parameter 'Logical channel SR Mask' in MacConfigUlDtch & MacConfigUlDcch.

CR410 support is enabled by using the optional parmaeter 'SR Prohibit Timer' in MacConfigUlsch.

For full Release-9 compliance must also have "SETP L2_MAC_ENABLE_CR379_R2_094167 1" for RACH.

3.1.3 Multi-UE Handover Operational information

Multi-UE handover operation requires 2 TM500 units to be connected together as described in the installation and configuration guide.

In the Multi-UE handover configuration a single TM500 unit acts as the master unit providing the MCI for control.

3.1.3.1 Configuration

The following command sequence is required to configure the system via the master MCI:

Instructs the TM500 to attempt to use other TM500s that may be connected as part of a single system.

MULT

Define radio context 0 as chassis 0 radio card RC1

SELR 0 0 RC1

Define radio context 1 as chassis 1 radio card RC1

SELR 1 1 RC1

Configure the mode, e.g. PDCP Mode

SCFG PDCP_MODE

Start the TM500 mode.

STRT

Note that the TMA may be configured to perform all the above steps automatically on connection.

3.1.3.2 Radio Context to Cell Binding

Once connected and configured the new command SetMueRadioContextCell is used associate a radio context with a specific cell on a specific frequency.

The command must be used for each radio context and performs a cell search and BCH decode. The command will fail if the specified cell is not detected in the radio context.

e.g.:

FORW MTE SETMUERADIOCONTEXTCELL 0 369 21400 20 [1]

FORW MTE SETMUERADIOCONTEXTCELL 1 123 21400 20 [1]

Note that the SetMueRadioContextCell command **must** be used for all radio contexts after the MULT command has been issued, even if the test to be performed used only a single cell.

3.1.3.3 PDCP Mode UE Configuration

The SetUeContext command is used to define that the following commands apply to a designated UE.

To configure services for a UE it is necessary for it to be associated with a specific cell by defining the cell ID and frequency. Using legacy scripts this can be performed by using the PhyCellSearch command to define the frequency and by defining the cell ID in subsequent configuration commands. In the handover configuration the PhyCellSearch command is now optional (as is decoding the BCH – both are performed by SetMueRadioContextCell) and a new command, PhySetRadioFreq, may be used to explicitly define the DL and/or UL frequency.

To define the cell ID PhySetServingCellId may be used as an alternative to specifying the cell ID in individual configuration commands (in which case “-1” replaces the cell ID in subsequent commands).

The frequency and cell ID defined for a UE must match that define for a radio context using SetMueRadioContextCell.

3.1.3.4 PDCP Mode Handover

A UE is commanded to handover by defining a configuration sequence with a different cell. When a configurations sequence activates and there is a change of cell (and the new cell exists in another radio context) then a handover is automatically performed.

The PhySetServingCellId command makes it possible to script a handover using very few commands. The command alone (when activated) will map the current configuration to the new cell, but it is typically necessary to also define a new C-RNTI using the PhyConfigPdcch command and to define a RACH dedicated preamble using the MacConfigRach command.

The PhySetRadioFreq is used if an inter-frequency handover is required. Note that inter-frequency handover is not supported.

3.1.3.5 NAS Mode UE Configuration

The SetUeContext command is used to define that the following commands apply to a designated UE.

To configure services for a UE it is necessary for it to be associated with a specific cell by defining the cell ID and frequency. This is performed using the RrcAptConfigCellSelection command. As in PDCP Mode, the frequency and cell ID defined for a UE must match that define for a radio context using SetMueRadioContextCell.

Note that (in the MUE handover configuration only) the cell ID may be omitted from the RrcAptConfigCellSelection command, in which case cell selection is performed.

3.1.3.6 NAS Mode Handover

A UE is commanded to perform a handover by network signalling – no UE commands are required.

To simulate the conditions for performing a handover the PhySetReportedCellMeasurements command is used to override the PHY layer measurement reports to the RRC and thus trigger measurement events to the network which should result in a RRCConnectionReconfiguration with mobility message from the eNB to request the handover.

In NAS mode cell selection and cell re-selection are performed. Cell selection may be disabled by defining a specific cell in the RrcAptConfigCellSelection command.

3.1.3.7 Compatibility with Non-Handover Multi-UE Scripts

The command interface is designed to be backwards compatible with existing Multi-UE scripts once the configuration and radio context to cell bell binding steps (described above) have been performed.

The changes to the command interface are design to simplify script creating and modification for PDCP mode handover test cases: it is no longer necessary to perform a cell search and BCH decode, and scripts which are generic with respect to the cell ID can now be created.

Existing NAS mode test cases can also be used, but new the test commands (e.g. PhySetReportedCellMeasurements) will be required to create handover scenarios.

3.1.3.8 Limitations

- Only 2 cells are supported and each must be connected to a separate radio card.
- Handover is only supported in NAS and PDCP modes.
- The RRCConnectionReconfiguration mobilityControlInfo must match the broadcast information on the destination cell.
- The external reference cannot be used on the slave TM500.

3.1.4 Mobility Model information

The TM500 supports mobility modelling features to simulate each UE experiencing different channel conditions in both DL & UL. This is provided by individual commands that can control specific aspects of the channel conditions and their effects, and an integrated Online Mobility Model (OMM) which consists of:

- a simulation of fast and slow fading channels in the downlink, with resultant influence on the CQI/PMI feedback information and the DL-SCH BLER,
- a simulation of fast and slow fading channels in the uplink, resulting in UL signals that are shaped in accordance with the selected channel profile.

The channel characteristics that can be simulated and the feature limitations are summarised below (please also refer to the Command Reference Manual).

- Simulates the fading profiles EPA 5Hz, EVA 5Hz, EVA 70Hz, ETU 70Hz, ETU 300Hz for Multi-UE (32 UEs).
- For UL transmission only SISO operation is supported.
- The fading is frequency selective and will only apply on PUSCH DATA, PUSCH DMRS and SRS. Note that the UL Control Channel (PUCCH) is not affected.
- The noise remains as set by PHYCONFIGULINTERFERENCE.
- The downlink SNR using the new command PhyConfigOnlineMobilityModel. This automatically feeds through into the DL-SCH BLER and the CQI/PMI reporting.
  The additional inputs into the OMM are eNB transmit power (the EIRP value defined in the

PhyConfigPucch command) and the downlink path loss (defined in the PhyConfigPathLoss command). The PhyConfigPathLoss can be used repeatedly to change the downlink path loss and hence define the slow fading characteristic.
The new measurement group MOBILITYMODEL provide instrumentation of the operation of the mobility model.
Note that the OMM should not be used together with any other commands for a specific UE used to generate BLER or control the reported CQI/PMI values.

- The downlink SIR via scripting of the CQI as reported to the eNB.
  The CQI may be overridden using the one-shot command PhyOverrideCQI, or using a preconfigured table with the commands PhyConfigCqiTable and PhyAddCqiTableEntry. Refer to the CRM for full details and additional usage information.
  The downlink BLER can be based on the channel model applied to the PDSCH decoder as described below.
  An offline mobility model tool is integrated into the TMA enabling the CQI override tables to be automatically created as described in section 3.1.4.2.
- The downlink BLER. This is configured using the following commands:
  - HarqConfigDlSchAckTable and HarqAddDlSchAckTableEntry for preconfigured table driven operation if a deterministic sequence of DL ACK/NACK results per HARQ is required.
  - HarqConfigDlSchForceErrors for one-shot configuration of a defined BLER value.
  - PhyConfigDynamicBler to simulate downlink BLER in the PDSCH decoder based on the channel conditions described by the current modelled CQI values, together with the signalled MCS and RB allocation, and accounting for retransmissions.
- The uplink BLER. This is configured using the following commands:
  - HarqConfigUlSchAckTable and HarqAddUlSchAckTableEntry for preconfigured table driven operation if a deterministic sequence of UL ACK/NACK results per HARQ is required.
    Note that this feature overrides the ACK/NACK information signalled to the UE from the eNB via the PHICH - the UL transport blocks are unaffected.
  - HarqConfigUlSchForceErrors for one-shot configuration of a defined BLER value.
    Note that this feature actually corrupts the UL transport blocks as transmitted to the eNB.
- The path loss using the command PhyConfigPathLoss.
- The uplink path delay using the command SetPathDelay.
  Note that some eNodeBs have a large path delay that is corrected by the first TA from the eNodeB. The first TA is used to adjust the timing for all UEs and this can result in failure to detect the RACH preambles from subsequent UEs as the preambles may then arrive at the end of a TTI, i.e. outside of the receive window.
  Using SetPathdelay UE ID> 768 for subsequent UEs will make sure all the preambles are sent at the TTI boundary.
  Note that since release V2.10.1 the PRACH preamble path delay is derived from the downlink timing rather than the calibrated uplink timing. Therefore there is now typically no need to use the SetPathDelay command for UEs after the first to connect.

The TMA contains a mobility model that can be used to generate CQI override tables from a top level description of the required channel type and characteristics. Details are provided in Test Mobile Application User Guide, chapter 12.

3.1.4.1 Table driven CQI rules and limitations

- All the scripted CQI tables must be loaded for all UEs before the first activation of any UE. This rule applies in all modes.
- The table becomes active for all UEs when the first UL activates.
- The “Delta T” values at an particular entry in the table must be the same for all UEs. The “Delta T” value can change from entry to entry within a table, but the time values must align across all UEs.
  The reason for providing a configurable “Delta T” value is to enable time varying profile to be configured such that there are long periods with no CQI changes, and periods with rapid CQI changes, but with the minimum number of table entries.
- Scripted CQI table reconfiguration is not supported.
- One-shot override CQI command (PhyOverrideCqi) has priority over table driven scripted CQI
- On handover the table position is reset to the start.

3.1.4.2 TMA Mobility Model Support

The TMA contains a mobility model that can be used to generate CQI override tables from a top level description of the required channel type and characteristics.

Refer to chapter 12 of the TMA User Guide for full details.

Note that use of the mobility model requires installation of the Matlab Component Runtime (MCR). This is available from the TM500 FTP site or directly via the following link:

http://www.mathworks.com/matlabcentral/fileexchange/5268-matlab-component-runtime-installer-automation

3.1.5 Machine to Machine Interface (M2MI)

The M2MI is an alternate means of controlling the TM500 MUE product based on an ASN.1 definition of the UE configuration. The M2MI is only applicable to PDCP and RLC modes of operation and is designed to simplify programmatic control of the TM500, i.e. by an external automation controller, as follows:

- ASN.1 definitions are provided for UE configuration information. The core of the ASN.1 configuration is based on the Mar ’09 version of 3GPP specification 36.331.
- An ASN.1 compiler can be used to generate data structures for the required programming language.
- The data structures can be populated by the automation controller to reflect a required configuration. These can then be processed by an ASN.1 encoder to produce a binary Packed Encoding Rule (PER) version of the configuration.
- The encoded version is then converted to an ASCII Hex string and input to the TM500 using the new command:
  FORW ASN < ASCII HEX string containing ASN.1 Configuration in PER format>
- Command responses and indications are also in ASN.1 format – these can then be automatically converted back into data structures.

Refer to the Machine-to-Machine Interface Reference Manual for full details. This document also describes the mechanism for converting scripts from the standard format to the M2MI format.

3.1.5.1 Limitations

The M2MI is based on 3GPP ASN.1 definitions. It is consequently less flexible than standard scripts, i.e. it does not permit the scripting of configurations which are not supported by 3GPP. An example of this would be DRB configurations using SRB logical channel numbers, which is possible using standard TM500 scripts, but not with the M2MI. This also impacts on script conversion: standard scripts which are non-3GPP compliant need to be corrected before conversion.

The M2MI is not supported in the MUE handover configuration.

3.1.5.2 TMA support for M2MI

M2MI format scripts can be run as raw scripts using the TMA. Note that no other explicit support for M2MI scripts is currently provided. The configurable option to run TMA test cases in M2MI format should not be selected.

3.1.6 EDIP+

The EDIP+ interface provides a consolidated interface for PDCP/RLC bearers, primarily for the transport of SRB and DRB data between the TM500 and an external controller, typically providing the RRC/NAS layer. The EDIP+ does not replace the EDIP, but is an enhanced alternative providing the following features:

- Separate SRB and DRB ports, with SRB prioritised.
- Addition of a length field to simplify message parsing.
- Restructuring the message header to place type information after the header.
- Addition of SYNC bytes to facilitate receiver resynchronisation.
- CNF is only sent if requested.
- Support for buffer status information to support flow control.
- User supplied SDU handle to be used in UL transmission confirmations.
- Nagle disabled to reduce latency. Note that Nagle should also be disabled at the client in order to support high data rates.
- Improved TCP efficiency.
- UDP and TCP support.

Refer to section 10 of the Command Reference Manual for full details.

3.1.6.1 Limitations

The following limitations apply in this release:

- The TM500_UL_DATA_TERM_REQ message is not supported.
- The TM500_STATUS_IND message is not supported.
- Multiple ports are not supported.
- Multiple interfaces are not supported.
- The TM500_UL_BUFFER_STATUS_CNF message ‘Max Num SDUs‘ value reports the minimum value across all bearers.
- The TM500_UL_DATA_ACK_CNF message ‘Transmission Result’ does not support the ‘Configuration Error’ and ‘Transmission Failure’.

3.2 Higher Layers Operational Information

Higher Layer functionality requires the TM500 LTE to be configured in NAS Mode. Using the TMA this is performed by selecting the “NAS Mode” option from the connection dialog.

Alternatively this can be configured using the MCI command “**SCFG NAS_MODE**”.

The test features provided by NAS mode are as follows:

- U plane test data is inserted/received as PDCP SDUs at the access bearer interface.
- C plane (SRB) data is terminated at the RRC. NAS commands are encapsulated within RRC PDUs.
- L1 and L2 configuration is performed by the RRC in response to commands from the TM500 NAS or from the eNB RRC and NAS.
- PLMN and Frequency must be specified
- The support and behaviour of Authentication and Security procedures can be configured.
- The following PHY test commands can be used:
  PhyOverrideCqi
  PhyConfigUlTiming.
  PhyConfigCqiTable
  PhyAddCqiTableEntry
- The following HARQ test commands can be used:
  HarqConfigDlSchOverride
  HarqConfigUlSchForceErrors
  HarqConfigDlSchAckTable
  HarqAddDlSchAckTableEntry
- In NAS mode the DL-SCH ACK table can only be enabled and disabled (using **HarqConfigDlSchAckTable**) when the UE is detached, and must be in a separate activation from the **NasConfigEmmRegister** and **NasConfigEmmDeregister** commands.
- The **PHYCONFIGSYSCAP** command is used to set the number of receive antennas, and the DL and UL categories. The default is category 2 and single receive antenna.
- Only the simulated USIM is supported configured by the USIMCONFIG command. All USIMCONFIG parameters are supported except for the PLMN lists.
- The **USIMCONFIG** command can only be used once per UE after the **SCFG** command is issued.
- The use of a particular PLMN can be forced using the **NASAPTCONFIGPLMNSELECTION** command.
- PLMN reselection in automatic mode is supported, including shared network environment with RPLMN, equivalent PLMN, EHPLMN, HPLMN, UPLMN and OPLMN. Higher priority PLMN search and user reselection not supported.
- The PPPoE data entity is the default, but pattern generation/evaluation using the PN and FF data entities is also supported, as is the UDI data entity. Refer to Section 3.3 for details.
- Only automatic registration is supported in the **NASCONFIGEMMREGISTER** command.

- The **RRCAPT** and **NASAPT** commands must be in the same activation as the **NASCONFIGEMMREGISTER** command.
- The downlink carrier frequency must be configured using the **RRCAPTCONFIGCELLSELECTION** command.
  If the optional cell ID parameter is provided then this forces the use of the designated cell.
  If the cell ID parameter is not provided then cell selection is performed in the designated frequency (supported in the handover configuration only).
- The NAS Authentication and Null Security mode are supported.
- The RRC Security procedure is supported.
- The support and behaviour of NAS Authentication and NAS and RRC Security procedures can be configured.
- It is now possible to configure NAS security but without the NAS Authentication procedure: The NasAptConfigCapability command parameter 'NAS Security options' may be set to 4, meaning NAS security mode is expected. Authentication procedure is not expected.
- To support NULL security with NAS security headers the following command must be issued prior to the **NASCONFIGEMMREGISTER** command:
  `FORW MTE NASAPTCONFIGCAPABILITY [3] [0x80] [0x80]`
- The last RPLMN is not stored in non-volatile memory. The value is only available after successful registration and until a power down or reset of the TM500 is performed.
- Cell reselection is implemented as per 36.304 with the following limitations:
  - It is only available in the MUE handover configuration.
  - Speed dependent scaling factor is not implemented.
  - Cell reselection with CSG cells is not supported.
- Access Barring is supported.
- Access Class Barring is supported based on the comparison of a random number against *ac-BarringFactor* if provided. Stored Special Access Class information is not supported.
- Multiple default radio bearers are supported using the **NASCONFIGPDN** command.
- RRC MCI component indications are provided to display the RRC connection status:
  - RRC Connection Re-establishment Started
  - RRC Connection Re-establishment Failure
  - RRC Connection Re-establishment Success
  - RRC Handover Complete
- RRC MCI component indications are provided to display the RRC cell selection/reselection status.
  The indications may be disabled using SETP RRC_DISABLE_CELL_CHANGE_IND_TO_MCI, section 3.5.10..
  The provided indications are as follows:
  - RRC Cell Selection
  - RRC Reestablishment Cell Selection
  - RRC Leave Connected Cell Selection
  - RRC Any Cell Selection

  - RRC Cell Reselection

- Handling blacklisted cells is supported. If certain cells are marked as blacklisted in measConfig IE of the RrcConnectionReconfiguration message then they will not be considered for evaluation and consequent measurement reporting. This behaviour can be disabled using SETP RRC_IGNORE_BLACKLISTED_CELLS_CONFIG, section 3.5.11

- The system information read from the MIB and SIBs is shared between all the UEs. Therefore a UE will typically only perform MIB and SIB reading from a cell if the information is not already available or valid, i.e. no other UE has already read the information from the cell or it is invalid.
  Note that for subsequent UEs accessing a cell the TMA protocol logging shows the MIB and SIB decoding so that the logging is consistent with all UEs performing the same cell selection/reselection procedure.

- After handover the UE will re-read the SIBs if they are not available or there are no active UEs on the cell. If a TrackingAreaCode changes is detected then a TAU procedure is performed.

- Connected mode paging is supported for both ETWS (see below) and system information change. Note that in the latter case the MIB and SIBs are re-read but, if there is a conflict between the new and current common channel configuration, the UE may fail subsequent reconfiguration and consequently the call may be dropped and re-establishment initiated.

- ETWS information is supported. The TM500 will display on the MCI the ETWS (Earthquake and Tsunami Warning System) information in SIB 10 and SIB 11 in response to a paging message with the IE etws-Indication.
  The format of the indication is:

```
I: CMPI RRC ETWS Information:UE Id:n
  SIB 10 information:
    <description of SIB 10 ETWS info>
  SIB 11 information:
     <description of SIB 11 ETWS info>
```

- On-Demand RRC Measurement Reporting is supported via the new commands RrcAptTriggerMeasEvent and RrcAptGetMeasurementConfig .
  The purpose of the RrcAptTriggerMeasEvent command is to enable an RRC measurement report to be scripted and sent on demand. The measurement report can relate to any RATs (by default the UE capability as reported to the network supports all RATs).
  Note that a measurement report can only be sent if an appropriate measurement configuration has been received in an RRC reconfiguration message. The RrcAptGetMeasurementConfig command outputs the current measurement configuration to the MCI to enable a valid measurement configuration to be used in the RrcAptTriggerMeasEvent command.

- Authentication SQN and AMF checks are enforced. SETP commands are provided to disable the checking. See NAS_DISABLE_SQN_CHECK (section 3.5.17) and NAS_DISABLE_AMF_CHECK (section 3.5.18) for details.

- The following Protocol Configuration Options (PCO) are supported:

  - IPv4 address allocation via DHCPv4

  - DNS server address.

Protocol identifiers are not supported i.e. there is no support for LCH, PAP, CHAP and IPCP.

- On demand TAU is supported using the command NASAPTTRIGGERTAU.
- The Active flag can be set in TAU procedures using the SETP NAS_ENABLE_TAU_ACTIVE_FLAG, section 3.5.25.
- On demand Service Request with the ability to set the RRC Establishment Cause is provided by the command NASAPTTRIGGERSERVICEREQUEST.
- The optional IMEISV to be included in Identity Request and Security Mode Complete messages the SETP NAS_ENABLE_IMEISV, section 3.5.26.

3.2.1 Protocol Logging Restrictions:

- Ensure the 'snapshot view' box is ticked if viewing any data below the RRC. PHY and signaling data can be very high rate and can cause the TMA to become unresponsive, and it may take the TMA a long time to recover after stopping logging.
- TheS32Q16RsrpIndBmpower value in L1_L0L1_CPHY_SCHR_INTRA_MEAS_SET_IND_CELL_INFO is a scaled value and should be divided by 65536 to convert to a value in dBm.

3.2.2 RRC and NAS Spec Compliance.

This release is compliant to the March '09 3GPP specifications by default. Where non backwards compatible code changes are required support for increments up to Dec '10 Release 8 and Release 9 is configurable via the following SETP commands:

- SETP RRC_ENABLE_JUNE_09
- SETP RRC_ENABLE_SEPT_09
- SETP RRC_ENABLE_DEC_09
- SETP RRC_ENABLE_RELEASE_9
  This controls the UE capability reporting, 36.304 CR 0129 (Cell reselection) and support for the R9 MAC parameters (see section 3.1.2).
- SETP NAS_ENABLE_JUNE_09
- SETP NAS_ENABLE_SEPT_09
- SETP NAS_ENABLE_DEC_09
- SETP NAS_ENABLE_MAR_10
- SETP NAS_ENABLE_JUNE_10
- SETP NAS_ENABLE_SEPT_10
- SETP NAS_ENABLE_DEC_10
- SETP NAS_ENABLE_R9_SEPT_09
- SETP NAS_ENABLE_R9_DEC_09
- SETP NAS_ENABLE_R9_MAR_10
- SETP NAS_ENABLE_R9_JUNE_10
- SETP NAS_ENABLE_R9_SEPT_10

- SETP NAS_ENABLE_R9_DEC_10

The non-backwards compatible CRs are as follows:

- 36.331 CR 160 Minor corrections to the feature grouping.
  Enable using SETP RRC_ENABLE_JUNE_09 or RRC_ENABLE_SEPT_09.
- 36.331 CR 200 Proposed update of the feature grouping.
  Enable using SETP RRC_ENABLE_SEPT_09.
- 36.331 CR 270 Feature grouping bit for SRVCC handover
  Enable using SETP RRC_ENABLE_DEC_09.
- 24.301 CR 230 New value for ESM timer T3482
  Enable using SETP NAS_ENABLE_JUNE_09 or NAS_ENABLE_SEPT_09.
- 24.301 CR 319 Removal of unnecessary TAU procedure after abnormal bearer allocation failure.
  Enable using SETP NAS_ENABLE_JUNE_09 or NAS_ENABLE_SEPT_09.
- 24.301 CR 246 Correct the UE behaviour of handling ESM message. Not backwards compatible.
  Enable using SETP NAS_ENABLE_SEPT_09 or
  NAS_ENABLE_SEPT_09_CR_246_397.
- 24.301 CR 397 Security protection of Security mode reject.
  Enable using SETP NAS_ENABLE_SEPT_09 or
  NAS_ENABLE_SEPT_09_CR_246_397.
- 24.301 CR 426 Correction QCI within EPS quality of service information.
  Enable using SETP NAS_ENABLE_SEPT_09
- 24.301 CR 439 Clarification to UE requested bearer modification procedure.
  Enable using SETP NAS_ENABLE_SEPT_09
- 33.401 CR282 and CR286 Clarification + additional handling of partial/full security context.
  Enable using SETP NAS_ENABLE_SEPT_09
- 33.401 CR504 Mapped QCI Handling in UE.
  Enable using SETP NAS_ENABLE_DEC_09
- 33.401 CR570 Default value for T3412
  Enable using SETP NAS_ENABLE_DEC_09
- 33.401 CR579 Integrity protection of DETACH REQUEST
  Enable using SETP NAS_ENABLE_DEC_09

3.3 NAS Mode Data Handling

PPPoE is the default data entity and does not require explicit configuration via DTE commands.

A PPPoE service is created for each default bearer. Dedicated bearers associated with the default bearer share the same PPPoE service.

Alternative data entity types are supported. Refer to section 3.3.2 for details.

U plane test data is inserted/received as PDCP SDUs at the access bearer interface.

C plane (SRB) data is terminated at the RRC. NAS commands are encapsulated within RRC PDUs.

3.3.1 PPPoE configuration

- The service name is “tm500_lte_<ip_address>_<ue_id>_<pdn_id>”, where:
    - <ip_address> is the TM500 IP address in standard dot format.
    - <ue_id> is the numeric identifier for the UE. This is 0 in the single UE product.
    - <pdn_id> is the PDN Identity provided by the user in the NASCONFIGEMMREGISTER command.
- For example: “tm500_lte_10.1.0.20_0_5”.
- Note that the following PPPoE client connection settings are required:
    - PPP software compression disabled.
    - TCP/IP IP header compression disabled.
- The PPPoE connection may be set as the default gateway. If not set as the default gateway then a route to each required destination must be manually configured.
- Note that the TM500 LTE stack does not currently support automatic DNS server discovery. DNS server addresses must be manually configured or IP address used instead of domain names, for example “212.58.253.68” instead of “www.bbc.com”.
- The client cannot connect to the PPPoE service until the underlying EPS bearer has been established.
- Typically it is necessary to use a separate PC (real or virtual) to run the client application to use the PPPoE connection for each UE.
- Third party SW (for example: RASPPPoE) may be used to support multiple PPPoE connections on a single PC running Windows XP. The built in driver from XP is not suitable. Note that after installing the PPPoE protocol properties must be changed to increase the number of PPPoE clients allowed (number of WAN ports). Note that RASPPPoE is not supported for Windows Vista.
- PPPoE does not work if default route has been set in the VxWorks boot parameters, ensure that the boot parameters do not have an address defined for the “gateway inet”.
- Note that it is not possible to use a router between the TM500 and the client PC wishing to connect using PPPoE. PPPoE tunnels over Ethernet and cannot traverse a router.
- To achieve high-throughput data testing over PPPoE with no packet loss, the choice of PC and networking hardware, OS and PPPoE client are crucial. We have tested two alternative PC configurations for best performance and full multi-session (MUE) support, one Windows-based, the other Linux-based:

  Linux (to achieve at least 370Mbps @ 1464B):

    - Recent PC with >2.5GHz Intel Dual/Quad Core CPU and PCIe.
    - A recent, reasonably high-spec Intel or Broadcom PCIe or on-board Gigabit Ethernet NIC.
    - Any Linux distribution with Kernel > 2.6.6. Tested: Ubunutu 9.04 Desktop. Note that for maximum data throughput, the Gnome GUI must be idle: any high-speed

end data application should run in a non-GUI-windowed SSH/telnet session (or in the background, or on a command shell), with the GUI idle.

- rp-pppoe configured as a Kernel-Mode plugin (this requires a patch to rp-pppoe-3.10, see TN AAS-2009-0708 for further details).

Windows (to achieve at least 360Mbps @ 1464B)

- Recent PC with >2.5GHz Intel Quad Core CPU (preferably Xeon) and PCIe.
- A recent, reasonably high-spec Intel or Broadcom PCIe Gigabit Ethernet NIC with NDIS 6 driver.
- Windows Vista, Windows 7 or Windows Server 2003+ (NB we have only tested with Vista so far).
- cFos Broadband Connect (latest version http://www.cfos.de/download/download_e.htm). Supports up to 64 simultaneous connections.

3.3.2 Alternative Data Entity Configuration

- To override the default selection of a PPPoE data entity the **DECONFIGEPSBEARER** command may be used to associate a specific data entity with a specific EPS bearer.
- The attributes can then be applied to the data entity to produce the required behaviour. The support attribute commands are:
  - **DeConfigFfgAttrib** (with **DeAddToFfgBuffer**) and **DeConfigPngAttrib**, used in conjunction with **DeConfigUlDataProfile** to define the UL traffic profile.
  - **DeConfigPneAttrib** and **DeConfigFfeAttrib** (with **DeAddToFfeBuffer**).
  - **DeConfigUdiAttrib**.
- Note that the data entity configuration must be performed prior to performing the **NasConfigEmmRegister** command.

3.4 Example NAS Mode Scripts

3.4.1 Registration with the network, combined NAS activation mode

The following command sequence initiates automatic registration with the network with IMSI 23591000001 and uses the combined activation mode, i.e. the activation indication is sent when all UEs have completed the requested command.

```
FORW MTE SETUECONTEXT 0

# To configure the number of receive antennas and the DL and UL PHY category
FORW MTE PHYCONFIGSYSCAP 1 2 2

# Configure the USIM IMSI
FORW MTE USIMCONFIG 1([24491000001 3] [] [] []) [] [0]

# See frequency to 21400 and Cell ID to 0
FORW MTE RRCAPTCONFIGCELLSELECTION 21400 [0]

# Disable RRC security procedure
FORW MTE RRCAPTCONFIGCAPABILITY [0]

# Set the required PLMN
FORW MTE NASAPTCONFIGPLMNSELECTION 24491
```

```
# Enable NAS Authentication, enable NAS security procedure. Set the ciphering
algorithm to NULL
FORW MTE NASAPTCONFIGCAPABILITY [3] [0x80] [0x80]

# Initiate the NAS Attach with automatic PLMN selection, PDN ID of 0 and IPv4
connection.
FORW MTE NASCONFIGEMMREGISTER 0(0 [0])

FORW MTE ACTIVATE -1
```

If the PLMN to use is not forced, the registration will try the last registered PLMN (if available), and then the home PLMN (23591 – derived from the IMSI).
The RRC is configured to only use cell 0 in frequency 2.14 GHz.

The ACTIVATE indication is only returned on completion, successfully or otherwise, of the registration procedure.
Separate indication messages provide the results of the registration procedure, for example:

```
I: CMPI RRC Cell Selection: UE Id: 0
    Cell Info:
          Cell Id: 0 DL Freq: 21400 Cell Type: Suitable

I: CMPI L2 Random Access Initiated :UE Id:0 (Connection Establish: Cell Id 0,
Dl Freq 21400)

I: CMPI L2 Random Access Complete :UE Id:0 (TC-RNTI: 0x9CF, TimingAdv: 0,
PreambleTxCount: 1)

I: CMPI MTE 0  ECM CONNECTION IND:UE Id:0

I: CMPI MTE 0 EMM REGISTER IND:UE Id:0
         Selected PLMN: 24491F
         EPS Bearer Id: 5
         Access Point Name: aeroflex.com
         IPv4 Address: 192.168.0.1

# Activation indication issued when all UEs have completed the requested
command
I: CMPI MTE 0 ACTIVATE IND: RETURN CODE:0
```

In the successful case, the IP address is the network assigned IP address assigned to the default bearer.

3.4.2 Registration with the network, individual NAS activation mode

The following command sequence initiates automatic registration with the network and uses the individual activation mode, i.e. the activation indication is sent on configuration.

```
FORW MTE PHYCONFIGSYSCAP 1 2 2

FORW MTE SETUECONTEXT 0

FORW MTE USIMCONFIG 1([24491000001 3] [] [] []) [] [0]

FORW MTE RRCAPTCONFIGCELLSELECTION 21400 [0]

FORW MTE RRCAPTCONFIGCAPABILITY [0]

FORW MTE NASAPTCONFIGPLMNSELECTION 24491

FORW MTE NASAPTCONFIGCAPABILITY [3] [0x80] [0x80]

FORW MTE NASCONFIGEMMREGISTER 0(0 [0])

FORW MTE SETUECONTEXT 1

FORW MTE USIMCONFIG 1([24491000002 3] [] [] []) [] [0]

FORW MTE RRCAPTCONFIGCELLSELECTION 21400 [0]

FORW MTE RRCAPTCONFIGCAPABILITY [0]
```

```
FORW MTE NASAPTCONFIGPLMNSELECTION 24491

FORW MTE NASAPTCONFIGCAPABILITY [3] [0x80] [0x80]

FORW MTE NASCONFIGEMMREGISTER 0(0 [0])
FORW MTE ACTIVATE -1
```

The ACTIVATE indication is only returned on configuration
Separate indication messages provide the results of the registration procedure, for example:

```
# Activation indication issued immediately
I: CMPI MTE 0 ACTIVATE IND: RETURN CODE:0

I: CMPI RRC Cell Selection: UE Id: 0
    Cell Info:
       Cell Id: 0 DL Freq: - Cell Type: Suitable

I: CMPI RRC Cell Selection: UE Id: 1
    Cell Info:
       Cell Id: 0 DL Freq: - Cell Type: Suitable

I: CMPI L2 Random Access Initiated :UE Id:0 (Connection Establish: Cell Id 0,
Dl Freq 21400)

I: CMPI L2 Random Access Initiated :UE Id:1 (Connection Establish: Cell Id 0,
Dl Freq 21400)

I: CMPI L2 Random Access Complete :UE Id:0 (TC-RNTI: 0x3E, TimingAdv: 0,
PreambleTxCount: 1)

I: CMPI MTE 0 ECM CONNECTION IND: UE Id: 0

I: CMPI L2 Random Access Complete :UE Id:1 (TC-RNTI: 0x43, TimingAdv: 0,
PreambleTxCount: 1)

I: CMPI MTE 0 ECM CONNECTION IND:UE Id:1

I: CMPI MTE 0 EMM REGISTER IND:UE Id:0
   Selected PLMN: 26280F
   EPS Bearer Id: 5
   Access Point Name: aeroflex.com
   IPv4 Address: 192.168.0.1

# New command specific indication showing that UE 0 has completed its
# NASCONFIGEMMREGISTER command
I: CMPI MTE 0 NASCONFIGEMMREGISTER IND:UE Id:0:RETURN CODE:0 SUCCEEDED

I: CMPI MTE 0 EMM REGISTER IND:UE Id:1
   Selected PLMN: 26280F
   EPS Bearer Id: 5
   Access Point Name: aeroflex.com
   IPv4 Address: 192.168.0.2

# New command specific indication showing that UE 1 has completed its
# NASCONFIGEMMREGISTER command
I: CMPI MTE 0 NASCONFIGEMMREGISTER IND:UE Id:1:RETURN CODE:0 SUCCEEDED
```

In the successful case, the IP address is the network assigned IP address assigned to the default bearer.

3.5 SETP Internal Test Commands

SETP commands are used to set the values of parameters that modify the behaviour of the TM500. They are typically used to configure at run time compliance to particular 3GPP CRs or to overcome short-term limitations or issues subject to specification clarification (missing/mismatched parameters, or unsupported functionality).

All SETP commands have a single numeric parameter.

Refer to the CRM Appendix B for details.

3.6 Circuit Switched Fallback (CSFB) Support

Refer to CRM Appendix D.

3.7 Documentation Notes

3.7.1 Command Reference Manual Changes

A new Command Reference Manual is with this release. Details of new/modified commands are listed below. Refer to the CRM for full details.

3.7.1.1 New Commands/Indications

3.7.1.1.1 RRC CMAS Information

Used to display the CMAS information received in SIB 12.

Scope

This indication message may be generated in NAS_MODE.

Description

Display the CMAS (Commercial Mobile Alert System) information in SIB 12 in response to a paging message with the IE cmas-Indication.

Syntax

```
I: CMPI RRC CMAS Information <PARAMETERS>
```

Indication parameters

The following indication parameter strings are concatenated together.

Parameter name	Text
UE Id	String indicating the UE Id: "UE Id:*n* " where *n* is the Id number of the UE as a decimal value.
SIB12 Information	String containing the CMAS information from SIB 12.

Example

```
I: CMPI RRC CMAS Information:UE Id:0
SIB 12 information:
  Message Identifier:4370 - CMAS CBS Message Identifier for
  Presidential Level Alerts
  Serial Number: 45066
  Geographical Scope:2 - Service Area Wide, Display Mode - Normal
  Emergency User Alert:1 - Activate emergency user alert
  Popup:1 - Activate popup on the display
  Update Number = 10
  Warning Message:
```

```
1F4F29C9E769FC3F4F29C9E769FC362ABCDEFA1F29C9E769FC362ABCDEF21362545878995DEF6A
2F857C48ABCDEF50125438B9FD6C2C4FCEFADC9A3A1A58A8E6F2B5E55EDAFFC8D9A4EE6D5A9FE4
EB5B99CA40F
  Data Coding Scheme: GSM 7 bit Default Alphabet
  Language: English
  Message: xxyyzz
```

3.7.1.2 Modified Commands/Indications

None

3.7.2 Measurement Reference Manual Changes

3.7.2.1 New Measurements

None

3.7.2.2 Modified Measurements

None

3.7.3 Document Errata

3.7.3.1 Command Reference Manual

None

3.7.3.2 Measurement Reference Manual

None

4 ISSUES RESOLVED IN THIS RELEASE

The following issues were resolved since S3.2.2

Id	Title
ubi00072041	Aeroflex TDD: MUE AF do not convert the protocol log for NAS and RRC
ubi00072059	Protocol Log Conversion taking forever to complete (specifically PROT_LOG_DSP2.dat)