Infrastructure Test System

TM500 HSPA Test Mobile

AEROFLEX
A passion for performance.

The industry standard test system for HSPA infrastructure development, test and demonstrations

Feature Highlights

- 3GPP Rel-9 DC-HSDPA compliant operation at Layer 1, Layer 2 and Higher Layers (RRC/NAS)
- 84 Mbps HSDPA Category 28, 10 MHz Dual Cell, 2x2 MIMO, multiple RF bands, handover
- HSUPA data rates to 11 Mbps
- Comprehensive control, measurement, data logging, display and analysis tools at all layers
- Powerful and scalable Software Defined Radio platform to support the future HSPA technology roadmap and maximize return on investment
- Flexible configuration of HSUPA, HSDPA and R99 functionality
- Innovative test features to assist NodeB/RNC and Core Network development
- Full support of HSUPA and HSDPA UE capability classes up to HSDPA Category 28, E-DCH Category 7
- Simultaneous HSUPA and DC-HSDPA operation at maximum data rates
- 2x2 MIMO support in the downlink
- Data Service Generator allows easy configuration of packet-switched service profiles
- High speed baseband logging
- Remote and automation API
- Optional Layer 3 RRC and NAS functionality to provide full-stack capabilities for system test
- Worldwide technical support and sales

The Aeroflex test mobile systems have been helping mobile infrastructure vendors develop their base stations since 2001. We understand the need for detailed logging and powerful debugging capabilities, precise control over system configuration and a layered, scalable approach to testing that mirrors your network development and evolves as the mobile standards evolve, ensuring a positive return on investment. We provide the expert, global support that you need to get the most out of the test systems at all stages, from initial setup through development testing and troubleshooting, to long-term automated regression test environments.

Used by all major infrastructure vendors, the TM500 Test Mobile platform has been the industry standard for 3GPP WCDMA and HSPA infrastructure development and test since 2003 and continues to be at the leading edge of technology developments. The Rel-9 DC-HSDPA options extend these features to include the latest 3GPP technology with data rates up to 84 Mbps and ensures that the TM500 is ideal for detailed lab-based testing and analysis of WCDMA and HSPA operation from basic channel configuration to complex packet-based services and applications, and from a single UE up to 32 UEs in one system.

About TM500

Innovative Test and Analysis

The TM500 offers full support for the latest Release 9 DC-HSDPA enhancements. This enables users to configure downlink data services across two 5 MHz cells with MIMO and 64-QAM enabled at rates up to 84 Mbps, while operating HSUPA services simultaneously on one cell at maximum rate in the uplink. DC-HSUPA will be available as a future product option.

The TM500 HSPA product is ideal for the infrastructure design, development and test engineer. A wide range of test modes and features are provided to assist the user in a structured development and test program. Test modes allow detailed analysis of Layer 1, Layer 2 and Layer 3 functionality and permit uplink and downlink physical channels to be verified and validated independently.

The Script Editor and Mobile Data Logger tools allow straightforward configuration of test sequences and measurement capture. Additionally the test process may be automated via the Proxy MCI interface for use in regression testing applications. It also features a Data Service Generator tool, which creates realistic uplink usage profiles of packet based services including voice, web browsing and gaming applications.

The TM500 Higher Layers option extends the features of the TM500 for use in full system test. In addition to full protocol support of Release 9 DC-HSDPA features at RRC and NAS, the option provides enhanced logging including full ASN.1 decode of all Release 9 RRC PDUs. The TM500 can be configured to support different HSUPA, HSDPA and R99 UE categories, enabling extensive system testing long before high data rate commercial mobiles are available.

Scalable Next-Generation Architecture

The TM500 Platform C is the latest hardware platform for the TM500 products. Featuring a scalable MicroTCA architecture and the latest DSP cards and with software support available for LTE FDD and TD-LTE in addition to WCDMA and HSPA testing, it is the best solution for current or future test mobile needs.

Expert Support

The TM500 product options are offered with a comprehensive worldwide support package. Members of Aeroflex's Field Application Engineering team are available to provide on-site and email support to help get the most out of your investment in the TM500.

Product Variants

Single UE Layer 1/Layer 2:

- Provides highly configurable Layer 1, HARQ, MAC, RLC and PDCP functionality in a variety of test modes. Each parameter can be controlled by the user and detailed logging per TTI is provided to enable detailed debugging of lower layer operation. A script editor is provided to simplify configuration.

Single-UE Higher Layer Protocol: Simulate a Full UE for End-to-End Testing

- Extends the product to support the full protocol stack, including support for a SIM card and AT commands. This enables end-to-end testing with real user data applications while maintaining access to the detailed logging and debugging information.

Multi-UE: NodeB Load and Scheduler Tester Supporting up to 32 UEs

- Simulates the Layer 1, HARQ and MAC functionality of up to 32 UEs to test NodeB scheduling and throughput
- Scripted feedback enables simulation of downlink fading environment per UE

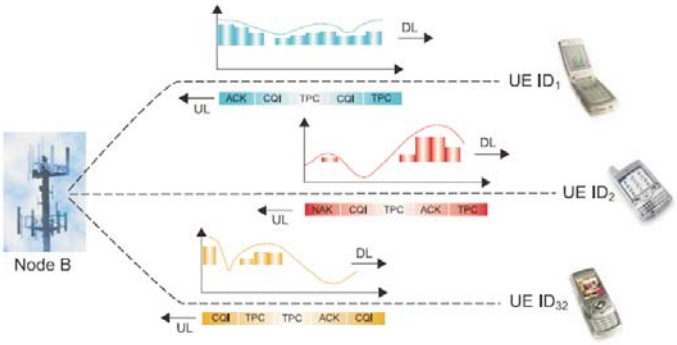

Figure 1. Simulation of multiple UEs with independent radio paths for NodeB scheduler testing

Test Modes

The TM500 incorporates a number of test modes which enable an incremental, layered approach to development and testing of the HSPA stack from the PHY layer and upwards. Detailed functionality can be tested at a modular level, enabling very early testing of NodeB features even during the development stage. The TM500 supports test features that enable early uplink and downlink operation to be validated independently. In addition, 3GPP control signalling can be overridden and scripted to enable early test of closed control loops or to simulate error or fault conditions.

Layer 1/MAC-e Mode

This mode of operation provides detailed test features targeting analysis of the PHY layer and HARQ retransmission processes. Used in conjunction with the charting measurement tools, these features enable the user to monitor the real time operation of the UL and DL physical data link.

Test features include:

- Comprehensive analysis of Layer 1 and MAC-e/es operation
- Independent BER and BLER analysis per cell for each HARQ process using data source/sinks configured to standard PN or user defined data sequences
- Data entry in MAC-e PDU or MAC-d PDU format
- Scripted data payload and retransmission characteristics per HARQ process
- Independent testing of uplink and downlink channels
- Scripted control of RSN, scheduling information, happy bit, E-TFCI and DDI/N combinations
- Support of chase combining and incremental redundancy for packet retransmissions
- Detailed logging of E-HICH, E-RGCH and E-AGCH information
- Closed loop testing using received E-HICH

MAC-d Mode

The MAC mode adds analysis of the full MAC operation to the PHY/HARQ functionality. MAC mode adds MAC header monitoring, MAC PDU creation and MAC SDU extraction to the HARQ mode. The received payload data is evaluated for each logical channel and HARQ using data sinks. BLER is measured using the post-HARQ CRC results. Each logical channel can be connected to a separate data source or sink.

L1/L2 Mode

L1/L2 mode adds support for full RLC functionality including transparent mode, unacknowledged mode and acknowledged mode operation. This enables the user to analyze the RLC, MAC and PHY operation within the NodeB. The data content is transmitted and received with or without the PDCP layer. L1/L2 mode control is via specific configuration commands as well as providing scripted control for SDU insertion into RLC buffers and for logging of data and state information.

Test features include:

- Support of RLC-TM, RLC-UM and RLC-AM modes
- Full E-TFC selection procedure derived from serving grant
- Support of scheduled and non-scheduled data
- Independent HARQ profile configuration
- Real-time grant override facility
- Scheduling information and happy bit derived from RLC buffer occupancy
- Simultaneous E-DCH/DCH uplink
- IP interface to support TCP/IP services
- High speed data logging
- Real-time logging of E-DCH baseband encoder chain

Full-Stack Protocol Mode

The full stack protocol product option adds state-machine driven RRC and NAS layers, support for U-plane data and connection to real world applications, plus support for a real USIM and AT commands. In this mode, the TM500 simulates a complete handset and provides detailed logging at all layers to enable system-level testing of the NodeB and core network.

Command and Control

Management of the TM500 is carried out through the PC-based Mobile Data Logger (MDL) and script editor software supplied with the system. The TM500 can also be controlled by an external system, such as a customer's remote automated test system.

The MDL and script editor software suite that provides an easy and intuitive user interface for creating and running test scripts; data logging and measurements as well as the analysis of test sessions and data. Scripts created in the script editor can then be run in MDL individually or grouped together to create automated test suites.

Measurements and Logging

The measurement tools in MDL enable the user to selectively log and display measurement information from the test. Detailed measurements from Layer 1, 2 and 3 tests can be displayed in real time using the charting facility. A protocol log displays the message sequence chart and message contents for layer 3 procedures. In addition, all measurements are logged to file for post test analysis. These log files can be used to replay test sessions within the charting tool or can be exported to other tools for further analysis.

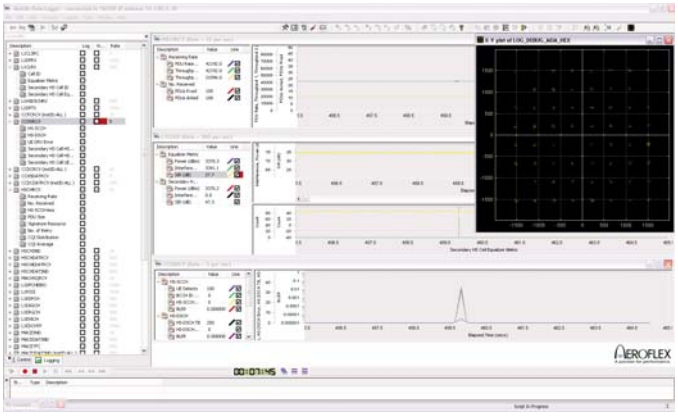

Figure 2. MDL and Constellation Plot

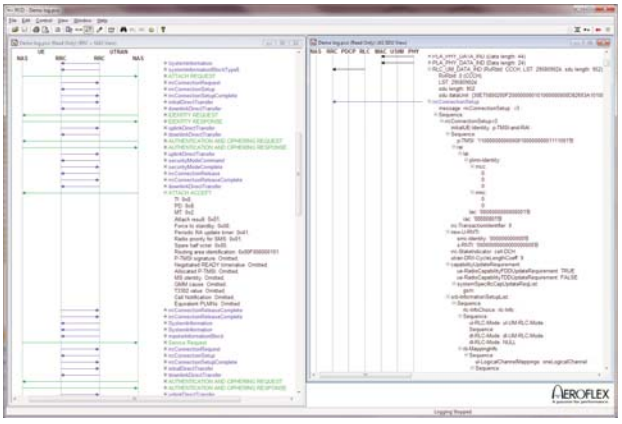

Figure 3. Protocol Logging Tool

	TM500-A[1]		TM500-B[1]		TM500-C	
	Single UE	Multi-UE	Single UE	Multi-UE	Single UE	Multi-UE
L1/MAC	Y	Y	Y	Y	Y	Y
RLC/PDCP	Y		Y		Y	
Higher layers (RRC/NAS)	Y		Y		Y	
3GPP R99	Y	Y[2]	Y	Y[2]	Y	Y[2]
Internal AMR codec[3]	Y					
3GPP Rel-5 HSDPA	Y	32 UEs DL	Y	16 UEs	Y	32 UEs
3GPP Rel-6 HSUPA	Y	16 UEs UL	Y	16 UEs	Y	32 UEs
3GPP Rel-7 HSPA+			Y	16 UEs	Y	32 UEs
3GPP Rel-8 DC-HSDPA			Y		Y	32 UEs
3GPP Rel-9 DC-HSDPA+MIMO					Y	32 UEs
3GPP Rel-9 DC-HSUPA					Y	32 UEs
Future developments					Y	32+ UEs

Overview of Technology Support Per Platform

1. Platforms A and B are no longer for sale, but software options are available for existing units.
2. The TM500 Multi-UE focuses on HSPA testing. R99 channel support per UE is limited to the channels required to facilitate this testing.
3. The AMR codec is not supported on the TM500 platform B or C, but the channels can be configured, and the 3GPP test loops are supported.

SPECIFICATION

3GPP SPECIFICATION

Specification Version

3GPP Release 9 (March 2010)

Operational Modes

FDD WCDMA

UE Capabilities

HSDPA Category 1-28, up to 84 Mbps

HSUPA Category 1-7, up to 11 Mbps

R99 DL: 2048 kbps, UL: 384 kbps

Simultaneous support of HSUPA Category 7 uplink with HSDPA Category 28 downlink

RF SPECIFICATION

TM500 HSPA test systems are designed for cabled operation.

Duplex

Variable duplex

Power Class

3 (+24 dBm)

L1 FEATURES

Modulation

Downlink QPSK, 16-QAM and 64-QAM (Rel-7)

Uplink QPSK and 16-QAM/4-PAM (Rel-7)

HSUPA Physical Channels

*E-DPDCH (up to 2*SF2 + 2*SF4), E-DPCCH*

E-AGCH, E-RGCH, E-HICH

HSDPA Physical Channels

HS-PDSCH (up to 15 codes per cell), HS-SCCH (up to 6 codes per UE (4 per cell). Maximum 14 codes per cell in Multi-UE), HS-DPCCH, F-DPCH

R99 Physical Channels

CPICH, SCH, P-CCPCH, S-CCPCH, DPDCH, DPCCH, PRACH, AICH*, PICH**

Transport Channels

E-DCH, HS-DSCH, BCH, DCH, PCH, RACH*, FACH**

Compressed Mode

SF reduction, higher layer scheduling

Transmit Diversity

Open loop (TSTD, STTD), closed loop (mode 1),

2x2 MIMO

Power Control

Closed loop (uplink and downlink), open loop (uplink), outer loop (downlink)

L2 FEATURES

Logical Channels

DTCH, DCCH, CTCH, CCCH, BCCH, SCCH, PCCH

MAC

MAC-d, MAC-hs, MAC-e/es, MAC-i/is (Rel-8)

*RLC**

RLC-TM, RLC-UM, RLC-AM

Flexible RLC in downlink (Rel-7) and uplink (Rel-8)

*L3/NAS FEATURES (PRODUCT OPTION)**

Protocol Layers

PDCP, RRC and NAS

SIM/USIM Support

AT Command Support

Enhanced RRC Messages Logging

Full ASN.1 decode of all R9 RRC PDUs

Configurable UE capability

MEASUREMENTS AND STATISTICS

HSUPA L1 Measurements

E-AGCH reception information, contents and status

E-RGCH reception information and status per radio link, resultant grant

E-HICH reception information and status per radio link, resultant HICH

E-DCH transmission information including E-TFCI, RSN, Happy Bit TBS, Code allocation, RV and puncturing attributes

Physical Channel transmit power information

HSUPA L2 Measurements

MAC-e transmission PDU contents and size information

MAC-e transport block scheduling and power scheduling information

Uplink Scheduling Information parameters

MAC-e throughput and retransmission statistics

MAC-es transmission PDU contents and size information

Logical channel multiplexing information

MAC-es throughput including scheduled and non-scheduled transmission statistics

*RLC send, receive, retry and discard statistics**

HSDPA L1/2 Measurements

HS-SCCH detection and decode information

HS-DSCH parameters and reception attributes,

HS-SCCH/HS-DSCH error statistics

HS-DPCCH uplink parameters

MAC-hs re-ordering information

MAC and RLC transmission and reception measurements, frame throughput and statistics*

R99 L1/2 Measurements

Support of 25.215 measurements, plus detailed cell search and dedicated channel information

USER INTERFACE

Mobile Data Logger (MDL)

Graphical application for the control of the TM500 and display of logged data

Script Editor

Graphical application for creating and editing the TM500 control scripts

Data Service Generator

Easy-to-use graphical interface to generate packet-switched service profiles

*Protocol Logging Tool (PCO+)**

Application for the control of SAPs used to observe and display logged data in a message sequence chart. Filters can be applied to aid analysis and debugging. Provided with L3/NAS option.

* These functions and features are not available on the Multi-UE product options

VERSION, OPTIONS AND ACCESSORIES

TM500 Platform C hardware and software options

Order number	Option	Availability	Notes
TM500-C	TM500 Platform C hardware Now		
TX512-C	HSPA+ L1/2 S-UE	Now	
TX513-C	DC-HSDPA L1/L2	Now	
TX514-C	Rel-9 DC-HSDPA L1/L2	Now	Requires TX513
TX515-C	Rel-9 DC-HSUPA L1/L2	Q2 2011	Requires TX514
TX525-C	HSPA+ Higher Layers S/W	Now	Requires TX512
TX526-C	DC-HSDPA H-Layers S/W	Now	Requires TX513
TX527-C	Rel-9 H-Layers S/W	Now	Requires TX514 or 515-C
TX555-C	HSPA+ L1/2 Multi-UE 32 UEs	Now	
TX557-C	DC-HSDPA Multi-UE 32 UEs	Now	
TX558-C	Rel-9 DC-HSDPA Multi-UE 32 UEs	Now	Requires TX557-C
TX559-C	Rel-9 DC-HSUPA Multi-UE 32 UEs	Q3 2011	Requires TX558-C

Product options on other platforms:

TM500 Platform A software options

(Note that new Platform A hardware is not available for purchase.)

Order Number	Option	Availability	Notes
TX535	HSPA Higher Layers S/W	Now	Supports HSDPA/HSUPA
TX540	HSPA Multi-UE S/W	Now	Supports HSDPA/HSUPA

TM500 Platform B software options

(Note that new Platform B hardware is not available for purchase.)

Order Number	Option	Availability	Notes
TX512-B	HSPA+ L1/2 S-UE	Now	Supports Rel-7 HSPA+ Features
TX513-B	DC-HSDPA L1/L2	Now	Requires TX512-B
TX531-B	MBMS L1/2 s/w. Platform B variant	Now	
TX525-B	HSPA+ Higher Layers S/W	Now	Requires TX512-B
TX526-B	DC-HSDPA H-Layers S/W	Now	Requires TX513-B
TX555-B	HSPA+ L1/2 Multi-UE	Now	Supports Rel-7 HSPA+ Features

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Our passion for performance is defined by three attributes represented by the icons pictured above: solution-minded, performance-driven and customer-focused.

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