SPIRENT™

UMTS Diagnostic Monitor and Test Automation Tools

Diagnostic Monitor Overview

- Diagnostic Monitors (DMs) are used to monitor UMTS User Equipment (UE) and network performance.

  ➢ Communicate to the UE device under test via device serial interface and device-specific cable.

- DMs monitor and record parametric data as well as Common Air Interface (CAI) messages.

  ➢ Parametric data, such as power levels, rake receiver, and UE status, is presented to the user in tabular and graphical formats.

  ➢ CAI messages are decoded and recorded for real-time or later analysis by the user.

Why Use Diagnostic Monitors?

- UE Manufacturers

  - Use DMs throughout the development cycle for testing and analysis of new and existing products.

    - By <u>Software Developers</u> to verify control algorithms for power, UE state, CAI messaging response and decoding etc.

    - By <u>Hardware Developers</u> to monitor and verify hardware RF performance and stability.

    - By <u>Deployment/Field Test Teams</u> as portable logging devices for Drive and Field Testing.

- Network Operators

  - Field and Drive Test Teams use DMs to verify proper UE and network performance

Why Use Diagnostic Monitors? (cont'd)

- ## Chipset Manufacturers

  - ➢ Use DMs to verify prototype designs

  - ➢ Supply DMs as development tools to their UE manufacturer customers

    - By using a commercial DM, chipset manufacturers can concentrate on developing products rather than support tools.

- ## UE Test Labs

  - ➢ DMs enable Automation

    - Give conformance test labs high levels of automation by allowing simultaneous UE control and monitoring.

Why Spirent?

- Spirent is the Automation Standard in CDMA
  - ➤ Adopted by Carriers, Test Labs, Handset and Chipset Mfgs.

Network Operators	Test Labs	Handset Mfgs	Chipset Mfgs
Verizon Wireless	ITS	Nokia	QUALCOMM
Sprint PCS	News IQ	Motorola	VIA
U.S. Cellular	PC Test	Sony-Ericsson	PrarieComm
Alltel	Lucent	Kyocera	
AT&T Wireless	Motorola	LG	
	Nortel	Samsung	

- Industry Leading Features
  - ➤ Common and uniform method with which to <u>monitor</u> and <u>automate</u> all UE devices

UDM Overview

- Chipset/UE Independent

- Monitor Multiple UEs Simultaneously

- CAI message logging with real-time XML decoder

- Real-time displays with playback

- Embedded Data Testing

- Powerful Automation & Scripting Environment

Rake Receiver (Fingers) and BER

Tx, Rx Power and RRC State
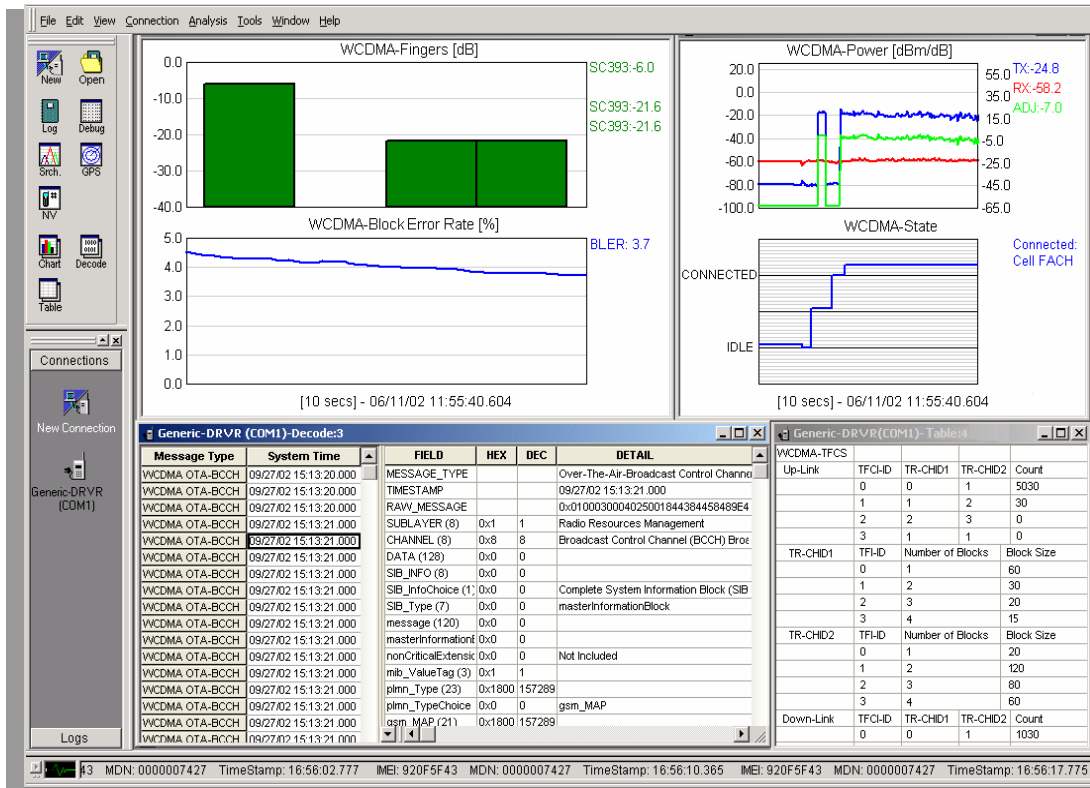
CAI message decoding

TFCS Table

UDM V2 - Data Logging

XML decoder engine provides flexibility and protection against specification volatility
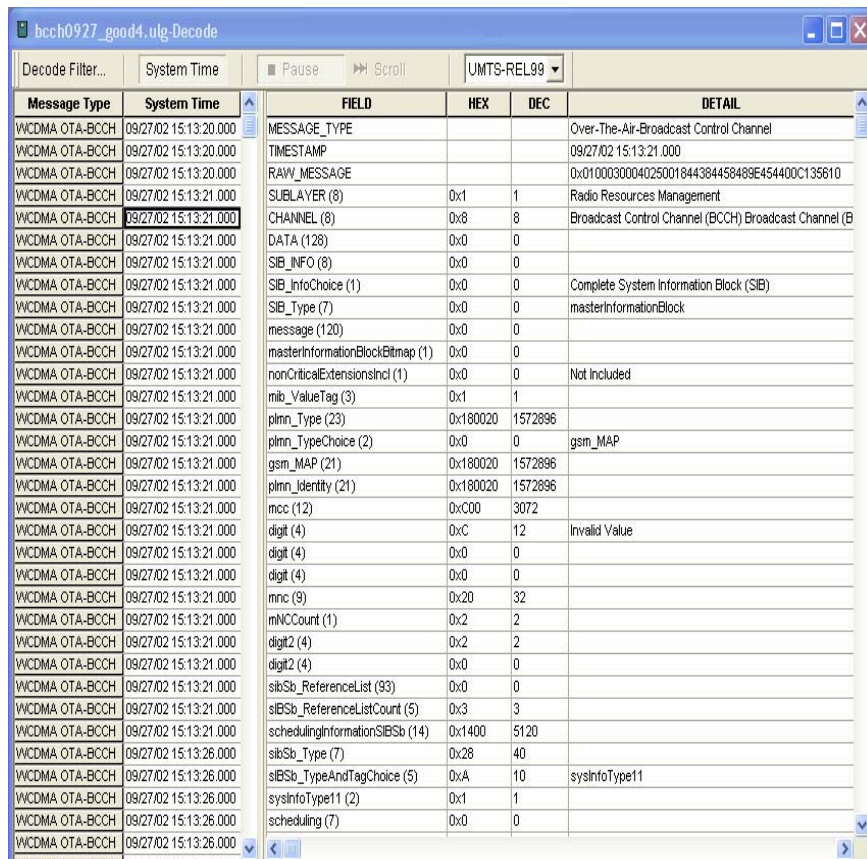
Powerful real-time data logging

Display, logging, decoding and playback of:
- CAI Layer 3 messages
- W-CDMA parameters
- Unique UE messages

Comprehensive Log Masks ensure only pertinent data is displayed and logged

Enhanced Find and Filtering to simplify Log File analysis

Real-Time Charting

- **User Configurable**
  - ➢ Over Time
  - ➢ Instantaneous
- **Logging and Playback of chart data**
- **View charts from multiple UEs simultaneously**
- **Charts**
  - ➢ RF Power (Tx, Rx, Pwr Cntl)
  - ➢ Rake Receiver Fingers
  - ➢ UE RRC State
  - ➢ Block Error Rate
  - ➢ Handset Throughput (Tx,Rx)
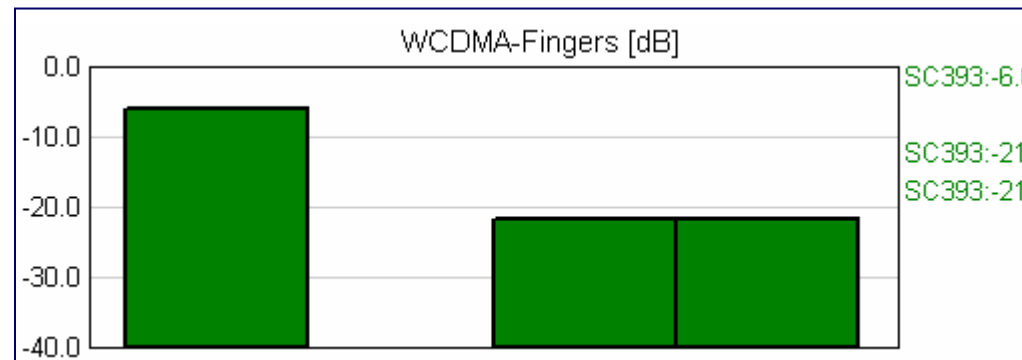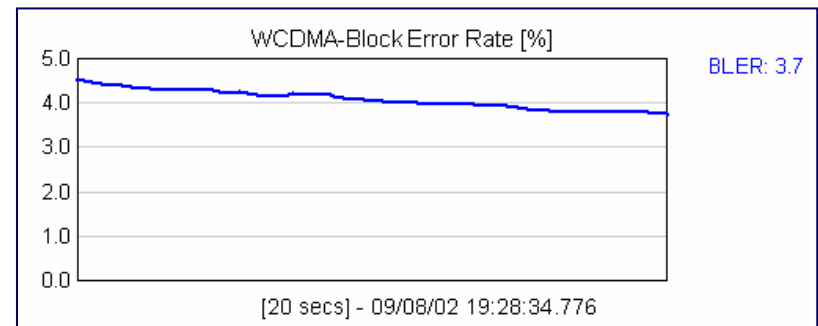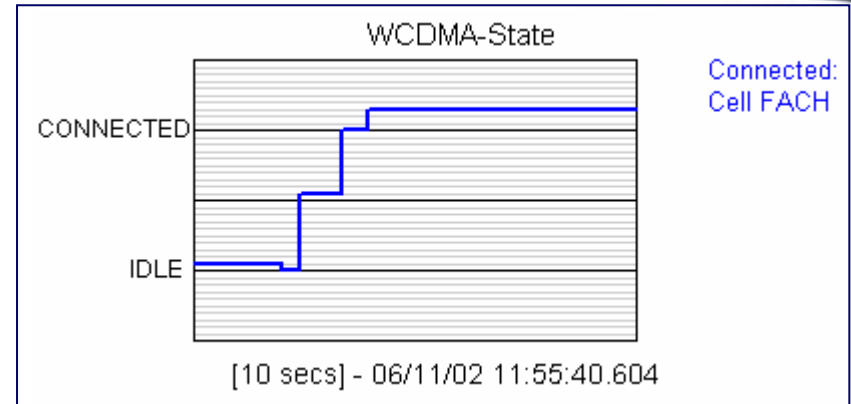
Customizable Table Views

- Windows uniquely filtered

- View tables from multiple UEs simultaneously

- Logging and Playback of table data

- Table data

  ➢ Handset Status Information

    • IMEI, State, HW/SW Version…

  ➢ W-CDMA Parameters

    • Channel, Pilot Set, TFCS,…

Real-Time Analysis

Individually configurable alarms reduce workload and post processing

- Automatic log file annotation for post analysis

- Plays customizable WAV file for audible alert

- Customizable Pop-up dialog for visual alert

- Alerts
  - Call Start/End
  - Dropped Call
  - Call Failed
  - Hard/Soft Handovers
  - Low Rx Power Level
  - Loss of UE Connection
  - Loss of GPS Data

Options dialog — Alarm tab:

Tabs: Log | Chart | Alarm | Searcher | Data | PN | Annotation | Debug

Alarm:
Device Connection
Dropped Call
GPS Data
Handoff
Protocol Revision In Use
Receive Power

Disable All

Alarm Settings:
☐ Enable Alarm
  ☐ Insert Annotation
  ☐ Show Dialog
  ☐ Play Audio

Advanced...

Defaults

OK   Cancel   Apply
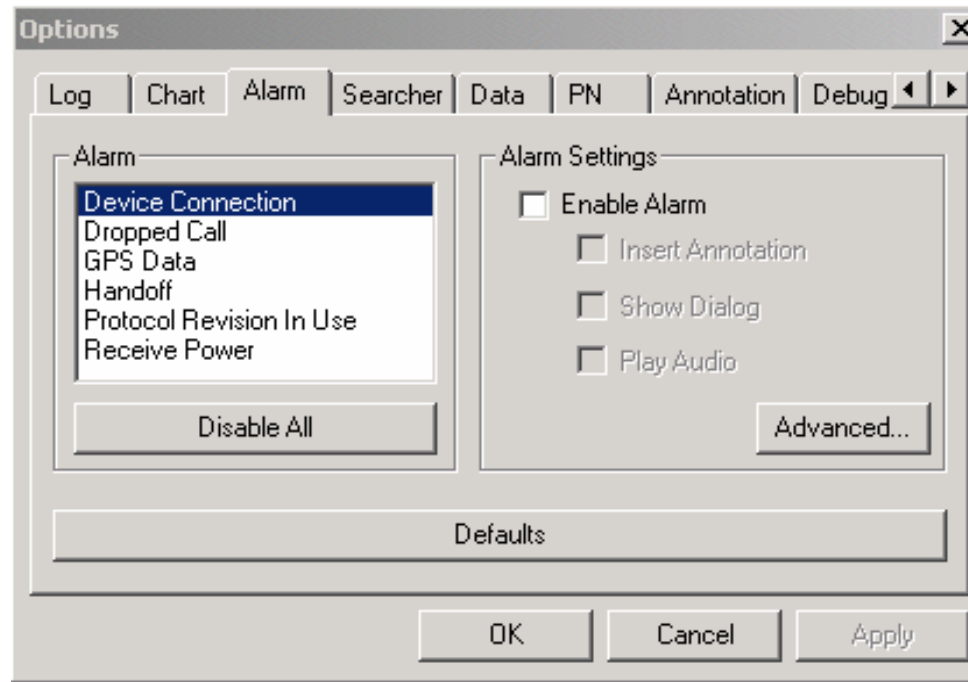
Automated Call Generation

- Voice call generation
  - ➢ UE Originated or Terminated calls
  - ➢ Real-time Call Statistics
  - ➢ Support multiple UEs simultaneously
    - Run synchronized or independent
  - ➢ Customizable call alarms

- Data call generation
  - ➢ Embedded Data Services:
    - FTP
    - HTTP
  - ➢ Log File Annotations
    - Transfer start
    - Transfer complete
    - Relative throughput

Bulk Call Demonstration

- ## Bulk Call Generation using VBScript

  - ➢ Remotely launch UDM to initiate logging of 16 phones simultaneously

  - ➢ Originates 32 calls simultaneously

UDM Architecture Overview

- Universal Tool Suite (UTS)
  - Core Architecture of UDM
  - Manufacturer and Chipset independent
  - Components
    - UTS Applications (e.g. UDM)
    - UTS Router
    - UTS Device Drivers
    - UTS Software Developers Kit (SDK)

- UDM-UMTS Application
  - Builds on CDMA Platform
  - Utilizes XML based Message Decoder for rapid adaptation to Standard changes
  - W-CDMA Specific Diagnostics

UDM Architecture Overview (cont'd.)
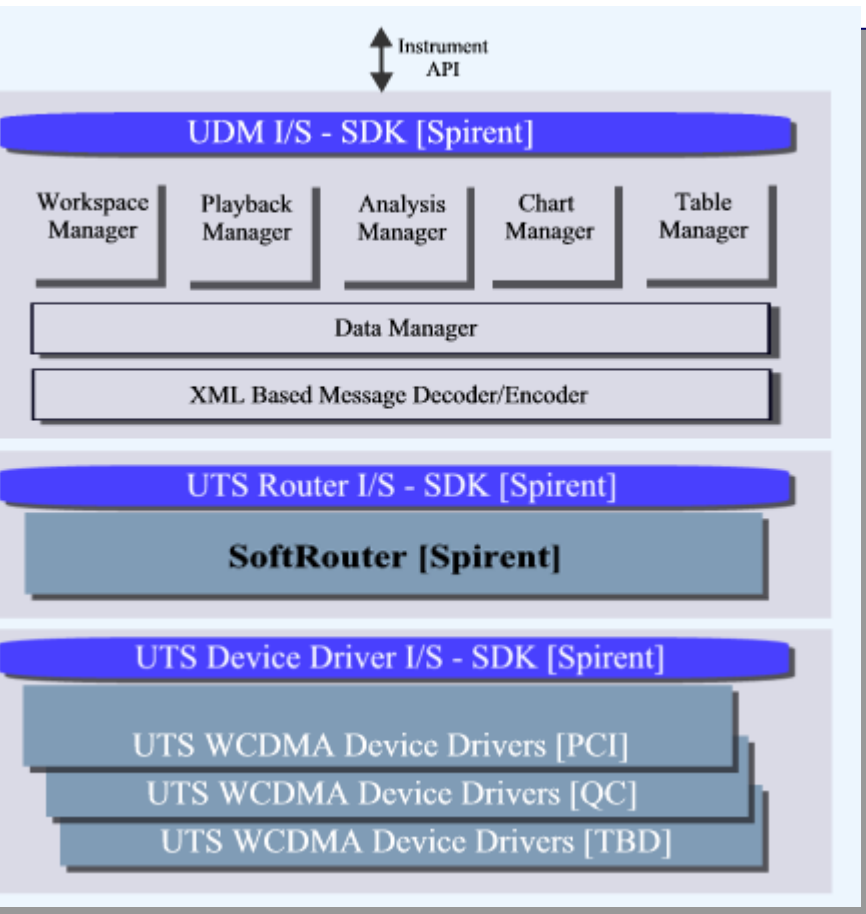
- **UTS W-CDMA Device Drivers**
  - Interface Between UE and UTS Router
  - Generic Drivers Developed by Spirent
    - Qualcomm – 1Q03 Deployment
    - PrairieComm – 2Q03 Deployment
    - Others – TBD (TI, National,…)
  - UTS Driver Development Pack
    - Complete package to help manufacturers develop custom drivers
      - Source Code
      - Training
      - Verification Testing

UDM Architecture Overview (cont'd.)
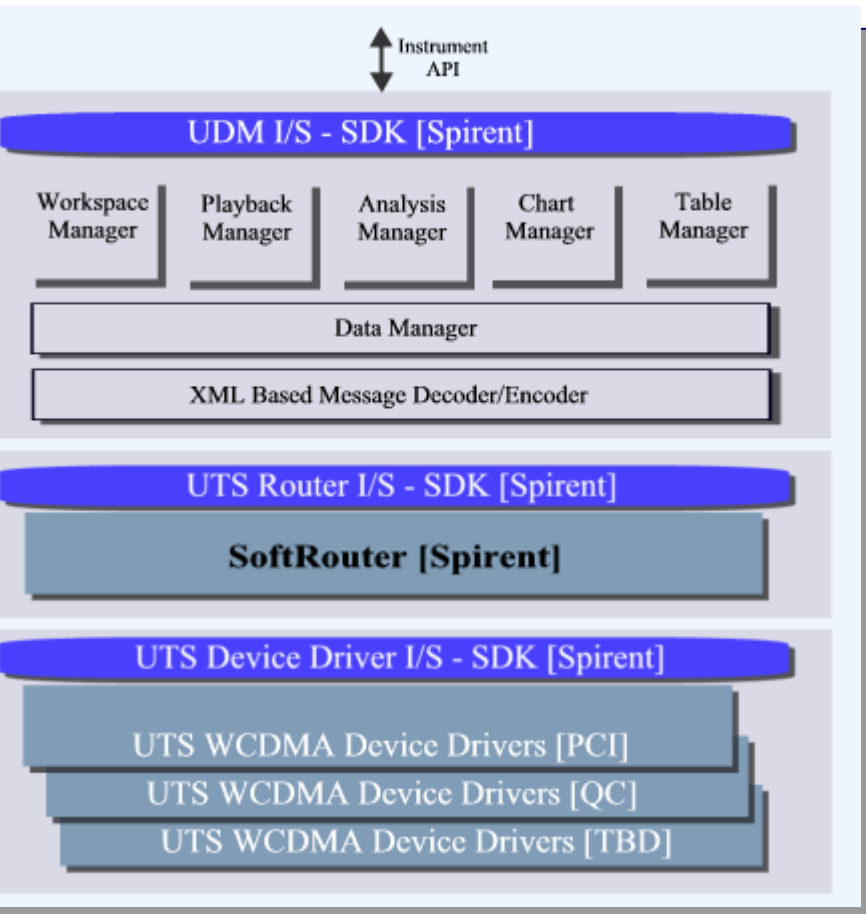
- UTS Software Development Kit (SDK)
  - ➤ UTS Interface Specifications
    - ➤ Used to Develop UTS Drivers
  - ➤ UTS Client Interface Specification
    - ➤ Defines API for Automated control of UDM
    - ➤ Defines Scripting Interfaces
  - ➤ Test Client
    - ➤ Used to Test UTS Device Drivers

SoftRouter™ Technology

SoftRouter™ Benefits

➢ Allows a single client to access multiple UEs

  (Drive test, one UDM with reference UE and test UE(s), for Side-by-Side comparisons)

➢ Allows multiple clients to access a single UE

  (Provides Test Automation such as custom Automation Software and UDM)

➢ Allows multiple clients to access multiple UEs

  (Parallel testing)

SPIRENT™   *Analyze │ Assure │ Accelerate™*
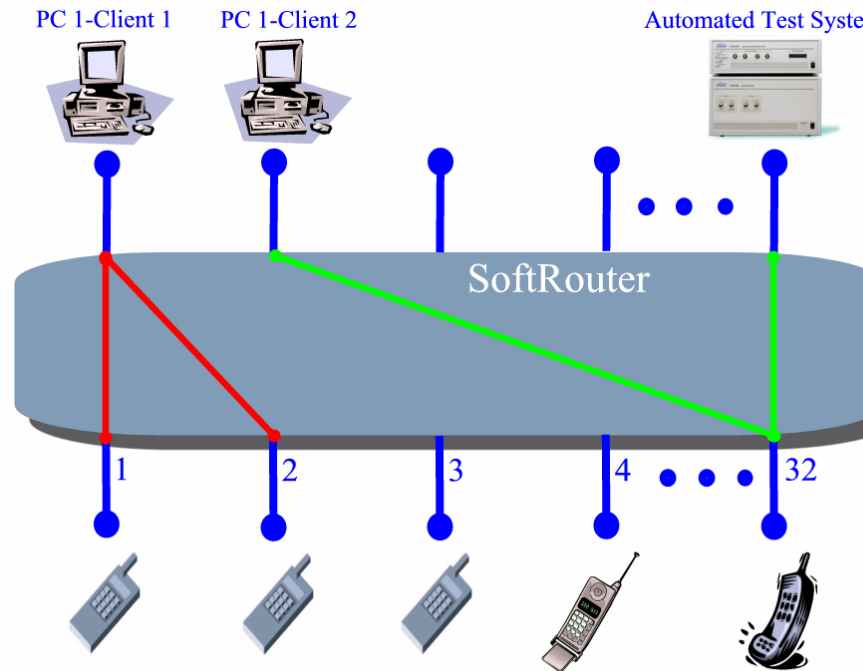
Automation

- UDM Enables Integrated Closed-Loop Test Systems e.g. Spirent U-ATS UMTS Automatic UE Test System
  - ➤ Integrates UDM diagnostics into the test process
- Scripting
  - ➤ Embedded and External scripting using VBScript

U-ATS System Configuration
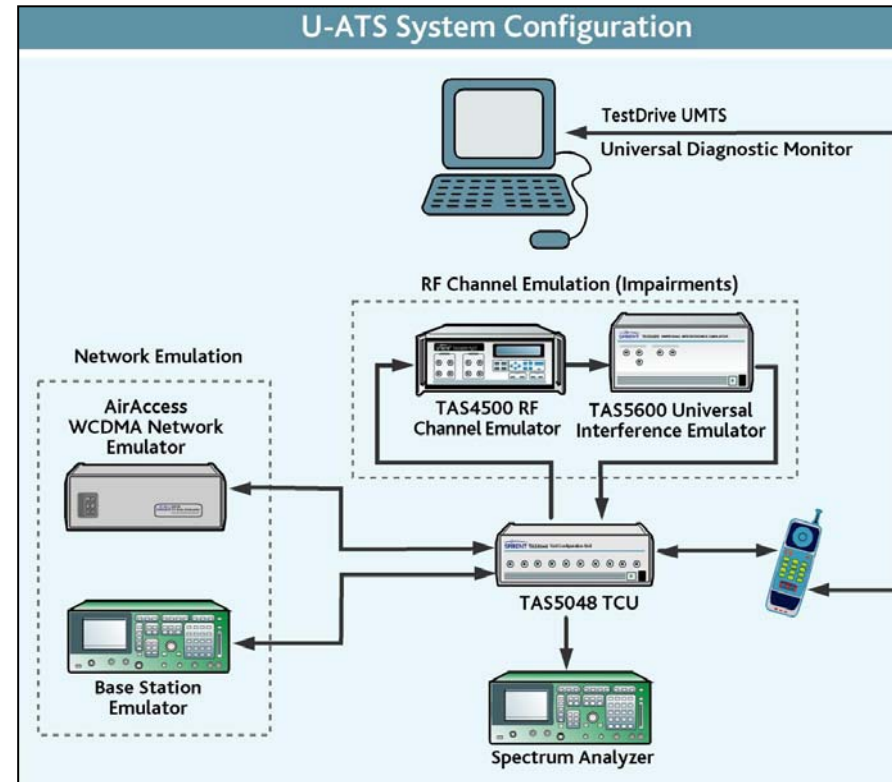
Additional Features

- ## UE SW debug messages
  - ➢ Trouble shoot handset performance/operation

- ## Position Location Ready
  - ➢ Advanced Charting and Analysis

- ## API for custom data
  - ➢ UE manufacturers can incorporate data structures for internal test/development

| System Time	MESSAGE	LVL	MOD	LN
06/12/02 21:18:31.731	Sort Prio, 4 Neig, chps=256, win=80	1	srchzz.o	6774
06/12/02 21:18:31.735	Last Wakeup: Aset_eng=5645, Rx=-59dB	2	srchzz.o	11326
06/12/02 21:18:33.010	RF sleeping	0	rfmsm.o	7917
06/12/02 21:18:34.219	Enabled digital Rx power	0	rfmsm.o	5781
06/12/02 21:18:34.217	RF card in PCS mode	1	rfcs.o	611
06/12/02 21:18:34.219	Card mode: 1 - Chan: 150	0	rfcs.o	718
06/12/02 21:18:34.220	Digital initialized	0	rfmsm.o	6429
06/12/02 21:18:34.215	skipped=93,residual=28672,early=24576	1	srchzz.o	1565
06/12/02 21:18:34.209	Wakeup roll: SymbComb ph=1 offset=6144	2	srchint.o	659
06/12/02 21:18:34.209	RF warmup complete	0	rfmsm.o	6503
06/12/02 21:18:34.215	Rcq Lst: r1=441 , r2=48	1	srchzz.o	6399
06/12/02 21:18:34.215	e1=173, e2=200	1	srchzz.o	6402

Handset-Location [meters]

Error:
LAT:+7
LON:-3

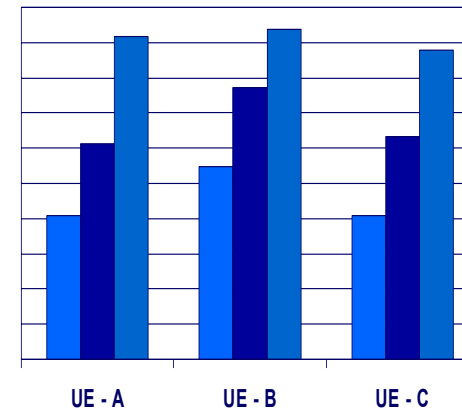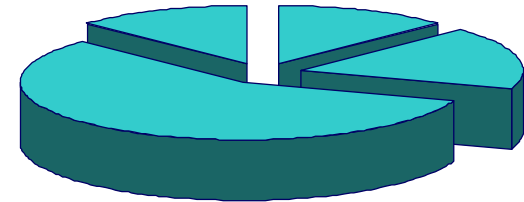[+/-15 meters] - 06/07/02 17:47:06.438
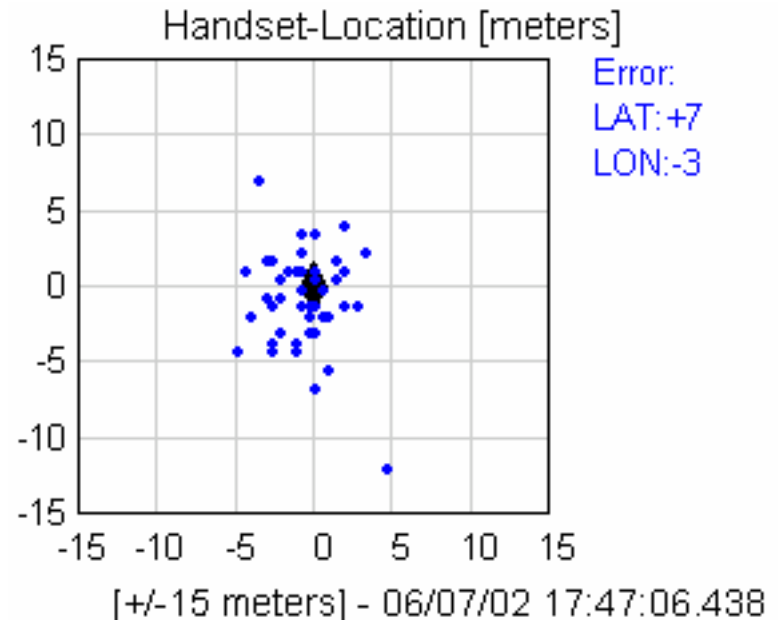
Product Roadmap

- Post Processing UE/Network Analysis Package for UDM
  - ➢ Mapping of user selected parameters
  - ➢ Standard and custom reports
    - Detailed Statistics reports
      - ➢ Pilot List Analysis (Pilot Pollution, Missing Pilots, …)
      - ➢ Call Statistics (Dropped, Blocked, Set up time, duration,…)
      - ➢ Handover Statistics (Hard and Soft with completion statistics)
  - ➢ Statistical analysis of user selected variables
  - ➢ Analysis of multiple log files simultaneously
  - ➢ PN Scanner Support
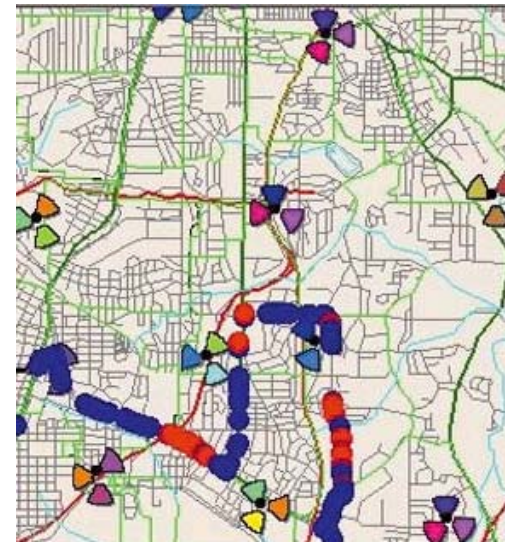
Product Roadmap (cont.)

- Real-time UE/Network Analysis Package thru UDM

  - Real-time mapping of drive route

  - "Snapshot" summary reports of current tests

    - Call Statistics
    - Handovers
    - Pilot Pollution

- Advanced post-processing and Network Optimization through Actix tools

- GSM support for inter-generational handover analysis

UE - A   UE - B   UE - C

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