

Test Patterns

Sensix™

A Closer Look at Test Patterns

CELL SOLUTIONS AS

your partner for today and the future ...



1

Introduction

Sensix™

- ◆ Voice Calls
- ◆ Messaging
 - SMS and MMS
- ◆ GPRS Application Level Tests
 - Internet Browsing
 - E-Mail
 - Wap
 - File Transfer
- ◆ GPRS Low Level Test
 - Data Pipe, Ping, DNS
- ◆ Scanning

2

Measurements in General Sensix™

- ◆ Radio measurements are logged in all tests
- ◆ Layer-3 messages are logged in all tests
- ◆ WTP (for MMS and Wap) are logged
- ◆ TCP/IP stack is instrumented and performance on each protocol layer is measured
- ◆ Measurements have ± 2 ms accurate timing

3

Voice Quality Sensix™

Voice Quality in Sensix™

- PESQ – ITU P.862 are used
- Voice quality scores are calculated for both uplink and downlink
- Voice samples may optionally be stored and can be listened to
- Voice Quality scores and statistics for voice quality can be presented in colors on the map, as graphs, or as numbers
- Calculates voice quality measurements for each 10 ms of the call



Details for one 5 seconds voice sample

4

PESQ – ITU P.862

Sensix™

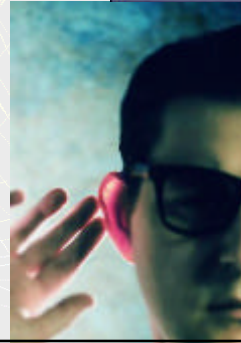
Voice Quality Algorithm - PESQ:

ITU standard P.862

- PESQ models the human ear and compensates for filtering that takes place in the mobile station and in the network.
- Compensate for network delays, which may be change several times during a test – like voice over IP.
- PESQ has been successfully tested to compare technologies and distortion scenarios for mobile networks, VoIP, and speech codecs

MOS –
Speech
Quality:

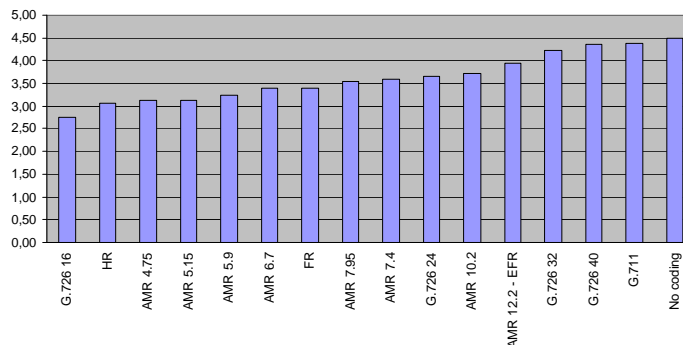
- 5 - Excellent
- 4 - Good
- 3 - Fair
- 2 - Poor
- 1 - Bad



PESQ vs Codec

Sensix™

- ◆ PESQ results for different codecs
 - Tested using a codec test application (no RF)



SMS Testing

Sensix™

- ◆ SMS messages are sent from MMU to MMU
- ◆ Timers are calculated
 - Transfer time
 - Send time
 - Receive time
 - Etc
- ◆ Timers are user-defined based on your own KPI
- ◆ Correctness of received message is verified



7

SMS Testing

Sensix™

- ◆ SMS message text are fixed, contains senders serial number and time
- ◆ Receiver control
 - Turn MS off and on
 - Make MS loose coverage
 - Measure time to deliver after MS is back on network

8

MMS Testing

Sensix™

- ◆ MMS messages are sent from MMU to MMU
- ◆ Timers are calculated
 - Transfer time
 - Send time
 - MMS Push time
 - Receive time
 - Etc
- ◆ Timers are user-defined based on your own KPI
- ◆ Correctness of received message is verified

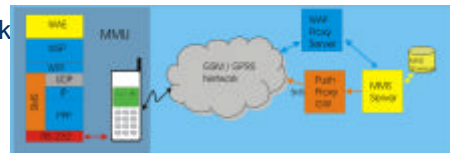


9

MMS Testing

Sensix™

- ◆ MMS message text part are fixed, contains senders serial number and time
- ◆ Contains one or more images, user controls message size
- ◆ Receiver control
 - Turn MS off and on
 - Make MS loose coverage
 - Measure time to deliver after MS is back on network
- ◆ MMS and WTP protocols are implemented in MMU for maximum control and tracing

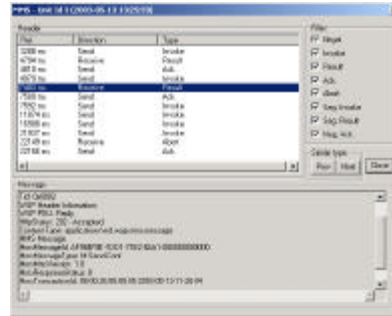


10

WTP Messages

Sensix™

- Wireless Transaction Protocol messages are shown fully decoded
- MMS message body are shown fully decoded
- Relevant for MMS and WAP tests
- Includes MMS Push message



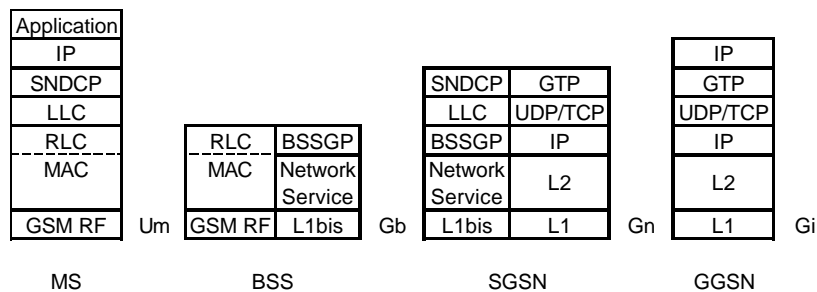
WTP/WSP messages for sending of MMS

11

GPRS Tests

Sensix™

- ◆ Test data between
 - MS
 - Servers beyond Gi

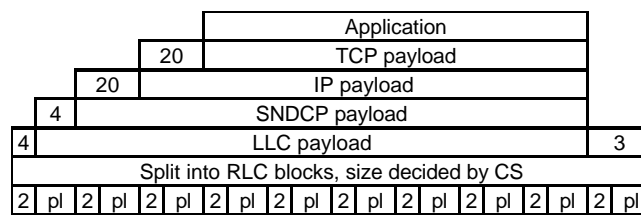


12

GPRS Tests

Sensix™

- ◆ Embedded instrumented TCP/IP stack
 - Collect statistics from each layer
 - Accurate timing



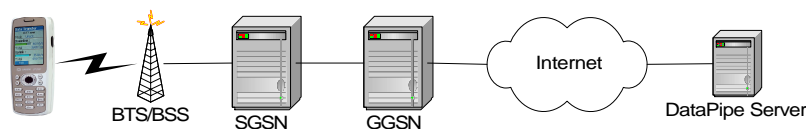
Numbers show overhead in each protocol layer

13

GPRS Low Level Tests

Sensix™

- ◆ UDP-based DataPipe test
- ◆ Send packets uplink and downlink
- ◆ DataPipe provides better GPRS throughput testing than application-level tests
- ◆ Stress-test SGSN, GGSN and BSS

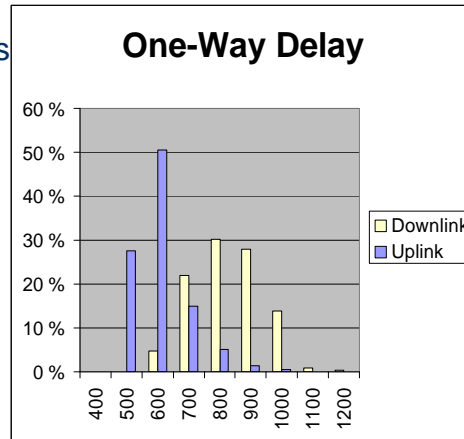


14

Data Pipe

Sensix™

- ◆ MMU send UDP packets to a Data Pipe Server
- ◆ Parameters
 - Packet size
 - Packet rate
- ◆ Measurements
 - Round-Trip Delay
 - One-Way Delay (ul/dl)
 - Packet Loss (ul/dl)
 - Throughput (ul/dl)
 - TBF life time



15

Data Pipe

Sensix™

- ◆ Enables detailed analysis on RLC level
- ◆ Block usage
 - Data to my MS
 - Data to other MS
 - Control messages
 - Idle
 - Physical Control
- ◆ Retransmissions

52 TDMA Frames

Time Slot	B0	B1	B2	TA	B3	B4	B5	I	B6	B7	B8	TA	B9	B10	B11	I
1	TFl=3	Ctrl Msg	TFl=3		TFl=8	Idle	TFl=3		TFl=8	Ctrl Msg	TFl=8		TFl=8	TFl=8	TFl=8	
2	TFl=3	TFl=8	TFl=3		TFl=8	Idle	TFl=3		TFl=8	TFl=3	TFl=8		TFl=8	TFl=8	TFl=8	
3	TFl=3	TFl=8	TFl=3		TFl=8	TFl=3	TFl=3		TFl=8	TFl=3	TFl=8		TFl=8	TFl=8	TFl=8	

16

Data Pipe

Sensix™

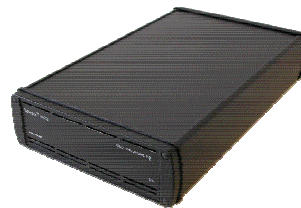
- ◆ Can set up different load patterns
 - Simulate streaming traffic
 - Simulate TCP
- ◆ Can help in investigating performance aspects
 - Cell Reselection performance
 - Spurious delays
 - Preemption
 - Buffering and delays in BSSGP
 - End-to-end throughput

17

Data Pipe Server

Sensix™

- ◆ MCU
 - Small
 - No maintenance
 - No keyboard or monitor
 - Configure with a laptop
- ◆ PC with NT/2000/XP
- ◆ Passive operation
 - Reply to packets/requests from MMU
 - Information is sent back in test packets
- ◆ Locate close to GGSN or at major ISP

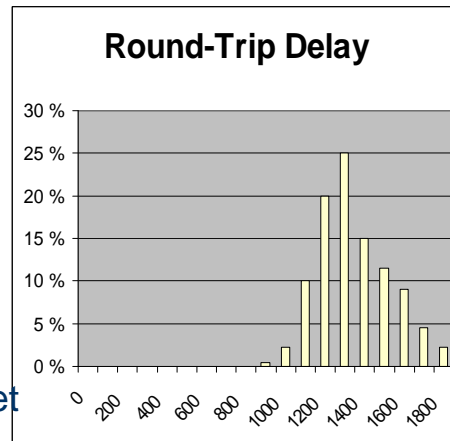


18

Ping (ICMP)

Sensix™

- ◆ MMU send ICMP packets to a host
- ◆ Parameters
 - Packet size
- ◆ Measurements
 - Round-Trip Delay
 - Success rate
- ◆ Any host can be target



19

DNS Lookup

Sensix™

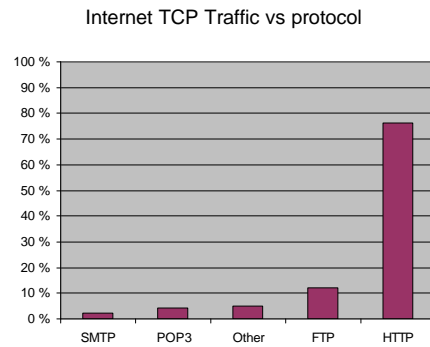
- ◆ MMU send DNS query (type A) to server
- ◆ Parameters
 - Hostname
- ◆ Measurements
 - Round-Trip Delay
 - Success rate
- ◆ Test target is DNS server using IP address from PDP Context Activation

20

GPRS Application Level Tests

Sensix™

- ◆ Tests
 - E-Mail
 - File Transfer
 - Internet Browsing
 - Wap
- ◆ Typical behavior
 - Stop-and-go
 - One way



21

E-Mail Sending

Sensix™

- ◆ SMTP – Simple Mail Transfer Protocol
- ◆ Parameters
 - SMTP Server
 - Recipient
 - Message Size
- ◆ MCU can be server
 - Discards all messages
 - Maintenance free

22

E-Mail Receiving

Sensix™

- ◆ POP3 – Post Office Protocol v3
- ◆ Parameters
 - Pop3 Server
 - Username and Password
 - Number of messages
 - Message size
- ◆ MCU can be server
 - Will always have messages
 - Maintenance free

23

Web Browsing

Sensix™

- ◆ HTTP – Hyper Text Transfer Protocol
- ◆ Parameters
 - URL
 - Follow redirect (Object Moved – 202)
 - Get sub pages and images
 - Get all referred pages (follow A HREF)
 - Get all referred pages on same server
 - Use HTTP 1.0 or 1.1 (use keep connection)
- ◆ MCU can be server

24

Wap Browsing

Sensix™

- ◆ WAP – Wireless Application Protocol
- ◆ Parameters
 - URL
 - WAP gateway
 - Follow redirect (Object Moved – 202)
 - Get sub pages and images
 - Get all referred pages (follow A HREF)
 - Get all referred pages on same server
 - Use WAP 1.1 or WAP 2.0
- ◆ MCU can be server (not proxy)

25

File Transfer

Sensix™

- ◆ FTP – File Transfer Protocol (put or get)
- ◆ Parameters
 - FTP Server
 - Username and Password
 - Filename (size and type)
- ◆ MCU can be server
 - Will always provide files of any size
 - ASCII or binary pseudo-random files

26

Scanning

Sensix™

- ◆ Scanning Hardware
 - DTI SeeGull
 - Sagem OT-190 / 290
- ◆ Scanning Modes
 - RSSI Scan
 - BCCH Scan with decoding
- ◆ Channels
 - Specify list
 - Follow MS (BCCH)
 - Follow MS (TCH, optionally adjacent channels)

27

QoS Settings

Sensix™

- ◆ For all GPRS Tests QoS can be set
 - Precedence class (High, normal, low)
 - Delay class (1 – 4)
 - Reliability class (1 – 5)
 - Peak throughput class (1 – 9)
 - Mean throughput class (1 – 18, 31)

28

Forcing Functions – GSM

Sensix™

- ◆ Forcing function
 - Static forcing
 - Applies to all tests in the session
- ◆ GSM Forcing
 - Power class (4 or 5 on 900, 1 or 2 on 1800)
 - Disable Enhanced Full Rate codec
 - Lock on 900 MHz or 1800 MHz
 - Allow camping on barred cells

29

Forcing Functions – GPRS

Sensix™

- ◆ Forcing function
 - Static forcing
 - Applies to all tests in the session
- ◆ GPRS
 - Multislot class (1+1, 1+2, 1+3, 1+4, 2+3, etc)
 - Downlink coding scheme (CS1, 2, 3 or 4)
 - MS GPRS Class (B or C)

30

Advanced Test Patterns Sensix™

- ◆ Available for GPRS testing
- ◆ A sequence of simple test steps
 - Test type with parameters
 - Attach, PDP Activate, Http, Sntp, Pop3, Ping...
 - Retry count
 - Timeout before retry
- ◆ A test fails if one of the steps fails
- ◆ Maximum time of the whole test is also given
- ◆ Test can be designed to simulate typical user behavior