

corresponding parameter views. *PKTGEN* can be configured and run for up to 16 data links by using the configuration tool within the "Parameter View." In the example, Forth scripts are used to configure and to start packet generation for a single data link.

*UMTSCOMP* receives the data, collects statistical information and calculates delays. Figure 18 shows the results of a typical test.

### 3. Conclusion

The K1297 Protocol Tester is a powerful tool for the design, development and deployment of new 3G networks. The K1297 is a comprehensive solution, adding simulation and emulation capabilities and an enhanced graphical user interface to the extensive monitoring functions of its predecessor, the K1205. The K1297 is compact and configurable to help you meet a variety of measurement challenges with ease, including:

- protocol functional tests
- node simulations, where the entire protocol stack is emulated/simulated, including the user plane.
- node tests, where all messages belonging to a message group can be collected.

The K1297 features programming flexibility and a common platform for all protocol testing applications. All bundles include:

- Monitoring
- Protocol simulation
- Emulation
- Sample scripts for message sequences, message pools and predefined emulation stacks
- Simulation Base software with Emulation Scenario Editor (ESE), Message Sequence Chart (MSC), Message Building System (MBS), PFE-Forth based interpreted scripting language

To address the new ATM features in the UMTS, K1297/ATM Software includes:

- Monitor and simulation software for UNI (Q.2931 CS2.1, ATMF UNI3.1, ATMF UNI4.0)
- Monitor and simulation software for NNI (Q.2761 - Q.2764 CS2.1, B-ICI 2.1)

- Monitor and emulation software for 8xSSCOP
- TTCN Compiler for Conformance Test Suites
- Executable Test Suites (SSCOP(SSCF), Q.2931, UNI3.1, Q.2763, MTP3b)
- Support for AAL 3/4, AAL 5, STM 4, STM 1 optical/electrical/TP, E3/DS3, E1/DS1, ATM 25.6 interfaces.

The following software packages are available:

- UMTS Monitor SW (G20) for Iu-PS user plane interface; incl.: GTP-U (TS29.060) and IP as well as underlying protocols UDP/IP and IP over ATM; English documentation; Required basic package >=V1.0 (7KK1220-OSCxx) and ATM-HW
- UMTS Test SW (G20) for Iu control-plane; incl.: Emulations of SSCOP, MTP3B, SCCP emulation and simulation of AAL2L3(Q.2630.1, Q.2150.2), RANAP(TS25.413) and Mobile Radio Layer 3 (TS24.008); English documentation; Required basic package >= V1.0 (7KK1220-OSCxx) and ATM-HW
- UMTS Test SW (G20) for Iu-PS user plane; incl.: simulation of GTP-U (TS29.060) and emulation of IP packet generator and comparator; English documentation; Requirements (7KK1220-OSCxx) >= V1.0 and ATM-HW

For additional information please also access our web site at [www.tektronix.com/commtest](http://www.tektronix.com/commtest).

This first release of the application note presents guidelines for the test engineer who is interested in solutions for the UMTS Iu interface as it was defined by 3GPP in 1999. Updates and solutions for the new Iub and Iur interfaces will follow in the near future. This document is also available at our web site ([www.tektronix.com](http://www.tektronix.com)), along with updates and related documents.

Tektronix is committed to the most advanced test solutions for mobile networks. As mobile networks continue to evolve through GPRS, UMTS and cdma2000, we will keep you in the forefront with the latest testing products and methods.

We welcome your comments and suggestions for improving these documents and your ideas for developing other tools to help you meet the measurement challenges of new wireless systems.

## 4. Appendix I

### 4.1 Recommended Documents and Standards:

3G TS 23.110	UMTS Access Stratum Services and Functions
3G TS 25.301	Radio Interface Protocol Architecture
3G TS 25.321	Medium Access Control (MAC) Protocol Specification
3G TS 25.322	Radio Link Control (RLC) Protocol Specification
3G TS 25.323	Packet Data Convergence Protocol (PDCP) protocol
3G TS 25.324	Radio Interface for Broadcast/Multicast Services
3G TS 25.331	Radio Resource Control (RRC) Protocol Specification
3G TS 25.401	UTRAN Overall Description
3G TS 25.410	UTRAN Iu Interface: General Aspects and Principles
3G TS 25.411	UTRAN Iu interface Layer 1
3G TS 25.413	UTRAN Iu Interface: RANAP Signaling
3G TS 25.420	UTRAN Iur Interface: General Aspects and Principles
3G TS 25.423	UTRAN Iur interface RNSAP Signaling
3G TS 25.430	UTRAN Iub Interface: General Aspects and Principles
3G TS 25.433	UTRAN Iub interface NBAP Signaling
3G TS 29.060	3rd Generation Partnership Project: Technical Specification Group Core Network; General Packet Radio Service (GPRS); GPRS Tunneling Protocol (GTP) across the Gn and Gp Interface
ETSI ETR 021	Advanced Testing Methods (ATM); Tutorial on protocol conformance testing (Especially OSI standards and profiles) (ETR/ATM-1002)
ETSI GSM 12.04	Digital cellular telecommunication system (Phase 2); Performance data measurements
IETF M3UA	G. Sidebottom et al, "SS7 MTP3-User Adaptation Layer (M3UA draft-ietf-sigtran-m3ua-02.txt (Work In Progress), IETF, 10 March 2000
IETF SCTP	R. Stewart et al, "Simple Control Transmission Protocol," draft-ietf-sigtran-sctp-v0.txt (Work In Progress), IETF, September 1999
IETF RFC 791	Internet Protocol
IETF RFC 768	User Datagram Protocol
IETF RFC 1483	Multi Protocol Encapsulation over ATM Adaptation Layer 5

IETF RFC 2225	Classical IP and ARP over ATM
IETF RFC 2460	"Internet Protocol, Version 6 (IPv6) Specification."
ITU-T I.361	B-ISDN ATM layer specification.
ITU-T I.363.2	B-ISDN ATM Adaptation Layer Type 2
ITU-T I.363.5	B-ISDN ATM Adaptation Layer Type 5
ITU-T Q.711	Functional description of the Signaling connection control part
ITU-T Q.712	Definition and function of Signaling connection control part messages
ITU-T Q.713	Signaling connection control part formats and codes
ITU-T Q.714	Signaling connection control part procedures
ITU-T Q.715	Signaling connection control part user guide
ITU-T Q.716	Signaling Connection Control Part (SCCP) performance
ITU-T Q.2100	B-ISDN Signaling ATM Adaptation Layer (SAAL) - overview description.
ITU-T Q.2110	B-ISDN ATM Adaptation Layer - Service Specific Connection Oriented Protocol (SSCOP).
ITU-T Q.2130	B-ISDN Signaling ATM Adaptation Layer - Service Specific Coordination Function for Support of Signaling at the User Network Interface (SSCF at UNI)
ITU-T Q.2140	B-ISDN ATM adaptation layer - Service Specific Coordination Function for Signaling at the Network Node Interface (SSCF AT NNI).
ITU-T Q.2150.1	AAL type 2 Signaling Transport Converter on Broadband MTP
ITU-T Q.2150.2	AAL Type 2 Signaling Transport Converter on SSCOP (Draft)
ITU-T Q.2210	Message transfer part level 3 functions and messages using the services of ITU-T Recommendation Q.2140.
ITU-T Q.2630.1	AAL type 2 Signaling Protocol (Capability Set 1)

## 4.2. Glossary

1G	First Generation
2G	Second Generation
3G	Third Generation
3GPP	Third Generation Partnership Project (of ETSI)
8PSK	Eight phase Shift Keying
AAL	ATM Adaptation Layer
AAL2	ATM Adaptation Layer Type 2
AAL5	ATM Adaptation Layer Type 5
AC	Authentication Center
ALCAP	Access Link Control Application Part
AMPS	Advanced Mobile Phone Service
AMR	Adaptive Multi-Rate (speech codec)
ANSI T1	Standards Committee T1 Telecommunication of the American National Standards Institute
ARIB/TTC	Association of Radio Industries and Business/Telecommunication Technology Committee
ASN.1	Abstract Syntax Notation One
ATM	Asynchronous Transfer Mode
AuC	Authentication Center
BEC	Backward Error Correction
BMC	Broadcast/Multicast Control
BSC	Base Station Controller
BSS	Base Station Subsystem
BTS	Base Transceiver Station
CAMEL	Customized Application for Mobile Enhanced Logic
CAP	CAMEL Application Part
CATT	China Academy of Telecommunication Technology
CBR	Constant Bit Rate (data stream)
CC	Call Control
CCITT	Comité Consultatif International Téléphonique et Telecommunication
CCS7	Common Control Signaling System No 7
CDMA	Code Division Multiple Access

CDMA2000	3rd generation Code Division Multiple Access
CC	Call Management protocols
CN	Core Network
CRNC	Controlling RNC (Radio Network Controller)
CS	Circuit Switched
CS-CN	Circuit Switched Core Network
CSE	CAMEL Service Environment
CT	Conformance Test
D-AMPS	Digital AMPS
DCH	Dedicated Channel
DECT	Digital Enhanced Cordless Telephone
DL	Downlink
DPC	Destination Point Code
DRNC	Drift Radio Network Controller
DRNS	Drift Radio Network Subsystem
DTE	Data Terminal Equipment
EDGE	Enhanced Data Rates for GSM Evolution
EFR	Enhanced Full Rate (speech codec)
EIR	Equipment Identity Register
ESE	Emulation Scenario Editor
ETSI	European Telecommunication Standards Institute
FDD	Frequency Division Duplex
FDMA	Frequency Division Multiple Access
FEC	Forward Error Correction
FER	Frame Error Rate
GGSN	Gateway GPRS Support Node
GMM	GPRS Mobility Management (protocols)
GMSC	Gateway MSC
GMSK	Gaussian Minimum Shift Keying
GPRS	General Packet Radio Service
GSM	Global System for Mobile Communication
GSM-R	GSM Railway
gsmSCF	GSM Service Control Function
gsmSSF	GSM Service Switching Function

GTP	GPRS Tunneling Protocol
GTP-C	GTP Control
GTP-U	GTP User
HLR	Home Location Register
HO/HoV	Handover
HSCSD	High Speed Circuit Switched Data
ICO	Intermediate Circular Orbits
IETF	Internet Engineering Task Force
IMEI	International Mobile Equipment Identification
IMT-2000	International Mobile Telecommunications 2000
IMUN	International Mobile User Number
IN	Intelligent Network
IP	Internet Protocol
IPv4	IP version 4
IPv6	IP version 6
IS-95	Interim Standard '95
ISDN	Integrated Services Digital Network
ISP	Internet Service Provider
ISUP	ISDN User Part
ITU	International Telecommunication Union
Iu	UTRAN interface between RNC and CN
Iub	UTRAN interface between Node B and RNC
Iu-CS	UTRAN interface between RNC and the circuit switched domain of the CN
Iu-PS	UTRAN interface between RNC and the packet switched domain of the CN
Iur	UTRAN interface between two RNCs
IUT	Implementation Under Test
IWF	Interworking Function
kbps	kilobits per second
LLC Relay	Logical Link Control - Relay
M3UA	MTP3 User Adaptation
MAC	Medium Access Control
MAP	Mobile Application Part

Mbps	Megabits per second
MBS	Message Building System
MC	Multi-Carrier
MC-CDMA	Multi-Carrier CDMA
MCE	Multi-protocol Encapsulation
ME	Mobile Equipment
MM	Mobility Management (protocols)
MSC	Mobile Services Switching Center, Message Sequence Chart
MSS	Mobile Satellite System
MT	Mobile Telephone
MTP	Message Transfer Part
MTP3b	Message Transfer Part level 3 (broadband) for Q.2140
NAS	Non Access Stratum
NBAP	Node B Application Protocol
NE	Network Elements
NMT	Nordic Mobile Telephone
NNI	Network-Node Interface
Node B	UMTS Base Station
NRT	Non-Real Time
NSS	Network Switching Subsystem
O&M	Operation and Maintenance
OSA	Open Service Architecture
OSS	Operation Subsystem
PDC	Personal Digital Communication
PDCCP	Packet Data Convergence Protocol
PDH	Plesiochronous Digital Hierarchy
PDN	Packet Data Network
PDU	Protocol Data Unit
PLMN	Public Land Mobile Network
PMR	Private Mobile Radio
PS	Packet Switched
PS-CN	Public Switched Core Network
PSTN	Public Switched Telephone Network

<b>QoS</b>	Quality of Service (ATM network channels)	<b>TACS</b>	Total Access Communication System	<b>VBR</b>	Variable Bit Rate (data stream)
<b>QPSK</b>	Quadrature Phase Shift Keying (or, Quaternary Phase Shift Keying)	<b>TAF</b>	Terminal Adaptation Functions	<b>VHE</b>	Virtual Home Environment
<b>RAB</b>	Radio Access Bearer	<b>TC</b>	Transcoder	<b>VLR</b>	Visitor Location Register
<b>RAN</b>	Radio Access Network	<b>TD-CDMA</b>	Time Division-Code Division Multiple Access	<b>VMSC</b>	Visited MSC
<b>RANAP</b>	Radio Access Network Application Part	<b>TDD</b>	Time Division Duplex	<b>WCDMA</b>	Wide band Code Division Multiple Access
<b>RLC</b>	Radio Link Control	<b>TDMA</b>	Time Division Multiple Access	<b>WLL</b>	Wireless Local Loop
<b>RLP</b>	Radio Link Protocol	<b>TD-SCDMA</b>	Time Division - Synchronous CDMA		
<b>RNC</b>	Radio Network Controller	<b>TEID</b>	Tunneling Endpoint ID		
<b>RNS</b>	Radio Network Subsystem	<b>TETRA</b>	TErrestrial Trunked Radio Access		
<b>RNSAP</b>	Radio Network Subsystem Application Part	<b>TIA</b>	Telecommunications Industry Association		
<b>RNTI</b>	Radio Network Temporary Identity	<b>TN-CP</b>	Transport Network-Control Plane		
<b>RR</b>	Radio Resource	<b>TPC</b>	Transmission Power Control		
<b>RRC</b>	Radio Resource Control	<b>TRAU</b>	Transcoder and Rate Adaptation Unit		
<b>RRM</b>	Radio Resource Management	<b>TS</b>	Technical Specification		
<b>RTT</b>	Radio Transmission Technology	<b>TTA</b>	Telecommunications Technology Association		
<b>SAAL</b>	Signaling ATM Adaptation Layer	<b>U MSC</b>	U MSC Mobile Switching Center (the integration of the MSC and the SGSN in one physical entity (UMTS+MSC = UMSC))		
<b>SCCP</b>	Signaling Connection Control Part	<b>U MSC-CS</b>	U MSC Circuit Switched		
<b>SCTP</b>	Simple Control Transmission Protocol	<b>U MSC-PS</b>	U MSC Packed Switched		
<b>SDH</b>	Synchronous Digital Hierarchy	<b>U SSD</b>	Unstructured Supplementary Service Data		
<b>SDO</b>	Standard Development Organization	<b>UDP</b>	User Datagram Protocol		
<b>SGSN</b>	Serving GPRS Support Node	<b>UE</b>	User Equipment		
<b>SIM</b>	Subscriber Identity Module	<b>UICC</b>	UMTS IC Card		
<b>SM</b>	Session Management protocols	<b>UL</b>	Uplink		
<b>SRNC</b>	Serving Radio Network Controller	<b>Um</b>	GSM Air Interface		
<b>SRNS</b>	Serving Radio Network Subsystem	<b>UMTS</b>	Universal Mobile Telecommunication System		
<b>SS7</b>	= CCS7 (Common Control Signaling System No. 7)	<b>UNI</b>	User-Network Interface		
<b>SSCF</b>	Service Specific Coordination Function	<b>UP</b>	User Plane		
<b>SSCOP</b>	Service Specific Connection Oriented Protocol	<b>USIM</b>	UMTS Subscriber Identity Module		
<b>SSF</b>	Service Switching Function	<b>UTRA</b>	UMTS Terrestrial Radio Access		
<b>STC</b>	Signaling Transport Converter	<b>UTRAN</b>	UMTS Terrestrial Radio Access Network		
<b>STM1</b>	Synchronous Transport Module - level 1	<b>Uu</b>	UMTS Air interface		
<b>SUT</b>	System Under Test	<b>UWC-136</b>	Universal Wireless Communication		
<b>SW</b>	Software				