K1297-G20 Protocol Tester

▶ UMTS Software

▶ Features & Benefits

Monitoring and Simulation/Emulation of Signaling Protocols at the Iu, Iub, Iur, Nb, Mc, and Nc Interfaces Ensure Quality Implementation of Protocol Definition and Behavior

Powerful Tools for Development and Test of UMTS Network Elements Allow Earlier and Cost Effective Availability of Adjacent Network Node Functions

Conformance Test Suites for GMM/SM and MTP3b Provide Main Test Suite Offering for Iu-PS

Simultaneous Handling of AAL2 and AAL5 Virtual Channels Allows Simultaneous Testing of Control and User Plane Protocols

Call Generation for MOC (Mobile Originated Calls)

Supports Interface Boards ATM E1/DS1 (Rx/Tx and Rx/Rx) and ATM STM1/ SONET OC3 Optical (Rx/Tx and Rx/Rx) to Cover the Needs of UMTS Networks

Data Generation of IP Traffic on Top of GTP Emulation Enables QoS and End-to-End Tests

Seamless Access to PCM Lines Using IMA (Inverse Multiplexing Over ATM) - No Separate Hardware Required

▶ Applications

Functional Testing of Protocol Implementations

System Testing of Network Nodes

Simulation of RNC, CN (SGSN/MSC), Media Gateway Controller, Media Gateway, and Node B

Monitoring of All Relevant Release 99 and Release 4 Interfaces and Protocols
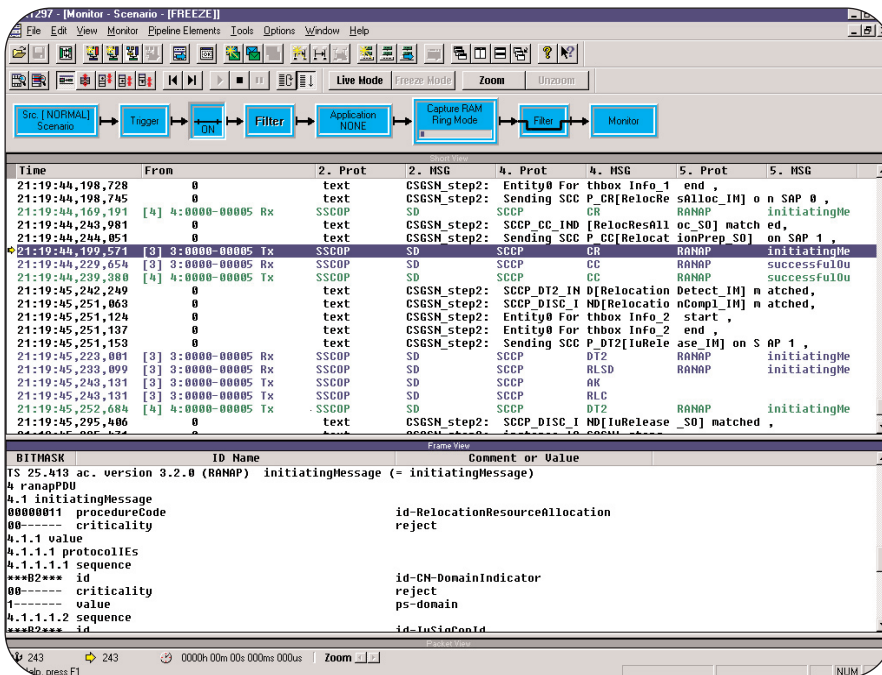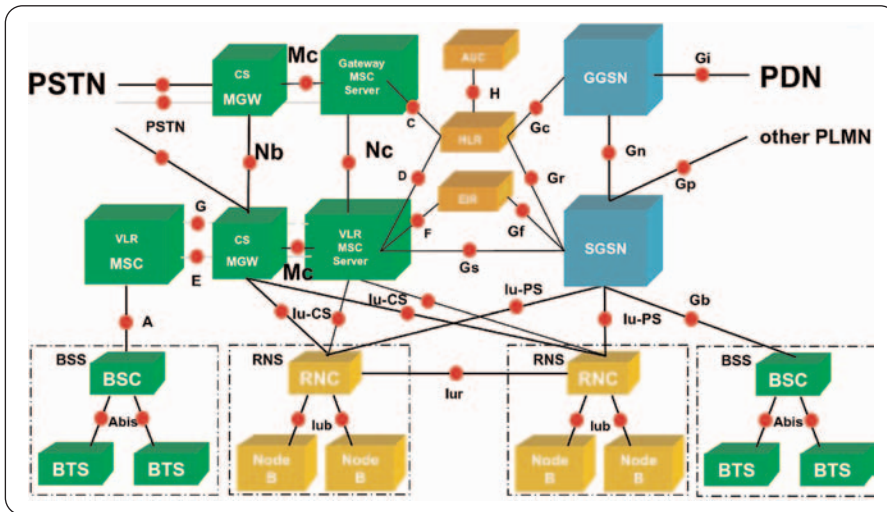
UMTS Software

As the third-generation mobile standard, UMTS allows sophisticated services through the latest CDMA and network technologies. Extensive simulation and monitoring test tools are required more than ever, due to the advances and complexity of developing, deploying, and operating these mobile networks. As a leader in the mobile measurement business, Tektronix offers solutions to meet Protocol Test challenges.

Software for the K1297-G20 Protocol Tester supports functional tests in UMTS R99 and R4 system development, and system tests for system integration. Monitoring, Simulation, and Emulation functions are provided for relevant UMTS signaling protocols and user plane protocols. Solutions are available for the most challenging test functions such as PER encoded RANAP, NBAP, and RNSAP protocols.

UMTS Iu, Iub, and Iur test software allows the RNC or CN at both sides of Iu interfaces, as well as RNC and Node B, to be simulated and tested. The software enables telecommunication equipment manufacturers to verify the software implementation of the RNC, CN, and Node B, ensures product development quality, minimizes development time, and reduces the risks for UMTS projects.

Release 99 (3GPP) UMTS standards are supported, and frequent upgrades to the latest version are made available (current up to September 2002). In addition, Release 4 (3GPP) UMTS standards are supported for a selection of UMTS/GPRS protocols (current up to December 2001).

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K1297-G20 Protocol Tester

▶ UMTS Software

▶ **Figure 1.** UMTS reference model, according to Release 99 and Release 4.

The software packages support the following test functions (selection):

▶ Monitoring and simulation of Iu UP (TS25.415)

▶ Monitoring and simulation of Iub FP (TS25.427, TS25.435)

▶ Monitoring and simulation of MAC (TS25.321)

▶ Monitoring and simulation of RLC (TS25.322)

▶ Monitoring and simulation of RANAP (TS25.413)

▶ Monitoring and simulation of NBAP (TS25.433)

▶ Monitoring and simulation of RNSAP (TS25.423)

▶ Monitoring and simulation of SABP (TS25.419)

▶ Monitoring and simulation of RRC (TS25.331)

▶ Monitoring and simulation of MM/CC/RR/GPRSMM/SM (TS24.008)

▶ Monitoring and simulation of SMS (TS23.040, TS24.011)

▶ Monitoring and simulation of supplementary services (TS24.080)

▶ Monitoring, simulation, and emulation of M3UA and SCTP

▶ Monitoring, simulation, and emulation of ALCAP (Q.2630.1, Q.2630.2, and Q.2150.1/2)

▶ Monitoring, simulation, and emulation of GTP (TS29.060)

▶ Monitoring, simulation, and emulation of PDCP (TS 25.323)

▶ Monitoring and simulation of BICC

▶ Monitoring and emulation of RTP/RTCP

▶ Send and receive speech on interfaces such as UMTS Iu. Iub, Nb, GSM A, and PSTN

▶ Emulation of IPv6

▶ Mobile originated call generation for circuit and packet switched calls by simulating RNC or CN at the Iu interface

▶ IP packet generator and comparator on top of GTP-emulation

▶ Conformance test suite for AAL2 Layer 3 (Q.2630.1)

▶ Conformance test suite for SSCOP/SSCF (Q.2110, Q.2140)

▶ Conformance test suite for MTP3b (Q.2210)

▶ Conformance test suite for GMM/SM (TS24.008)

UMTS Reference Model

UMTS architecture can be seen as the next step beyond the 2G and 2.5G technologies (GSM and GPRS). Thus, UMTS will not replace these technologies and their network elements, but will extend the network architecture. UMTS R99 introduced new network elements, such as the Radio Network Controller (RNC) and Node B, as shown in Figure 1. These two new network elements will form three new UMTS specific interfaces:

▶ The Iu interface between RNC and MSC/SGSN, with the Circuit Switched (CS) and Packet Switched (PS) part

▶ The Iub interface between RNC and Node B

▶ The Iur interface between RNCs

UMTS R4 introduced new network elements such as the MSC Server and the Media Gateway (MGW), as well as new interfaces Nc, Nb, and Mc, as shown in Figure 1. In addition, new functionalities have been added to already existing UMTS/GPRS protocols.

These new elements, the interfaces between them, and the great number of new protocols create a huge demand for test applications. Examples of test configurations that can be handled with the K1297-G20 UMTS solution are described on the next page.
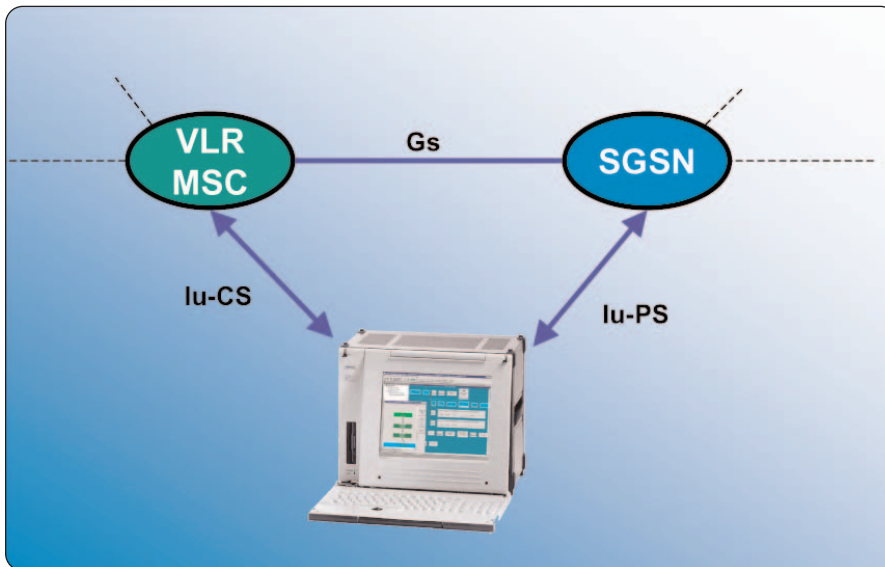
▶ *Figure 2. K1297-G20 simulating a Radio Network Controller (RNC).*
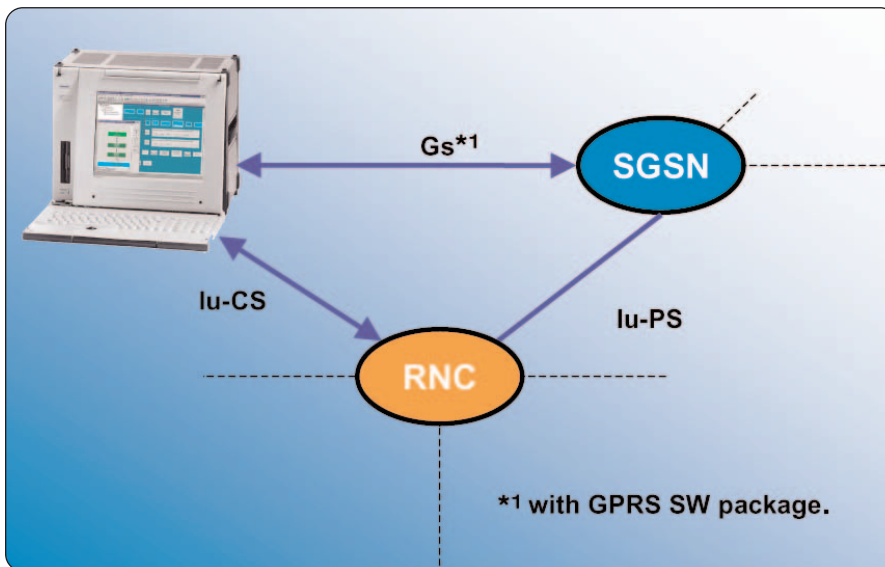
▶ *Figure 3. K1297-G20 simulating a MSC towards RNC and SGSN.*

Figure 2 shows a K1297-G20, which simulates the RNC network element towards the MSC and SGSN. Depending on the test purpose, the protocol layer will be simulated or emulated. The message flow for the protocol to be simulated is usually defined in a simple way with the Message Sequence Chart (MSC) Tool offered by the K1297-G20 Base Software. Emulations, which behave according to the standards, are used for all layers below the simulated protocol layer.

In Figure 3, the K1297-G20 simulates a MSC towards the SGSN and the RNC. This configuration requires the appropriate GPRS packages for G_s interface simulation. Applications, such as the Call Generator, help to test the basic call handling.

K1297-G20 Protocol Tester

▶ UMTS Software

Although the K1297-G20 was designed for Simulation/Emulation purposes, it is also possible to use it as a monitoring device. Monitoring UMTS interfaces adds additional test challenges. As the physical layer is often optical in nature (e.g., STM1 optical) it is not possible to hook the unit to an interface without disconnecting the lines between the network nodes unless there are special monitoring points. In addition, an optical coupler (each direction) may be necessary to allow passive monitoring. The K1297-G20 in Figure 4 monitors the complete Iu interface (Iu-CS and Iu-PS) at the same time.
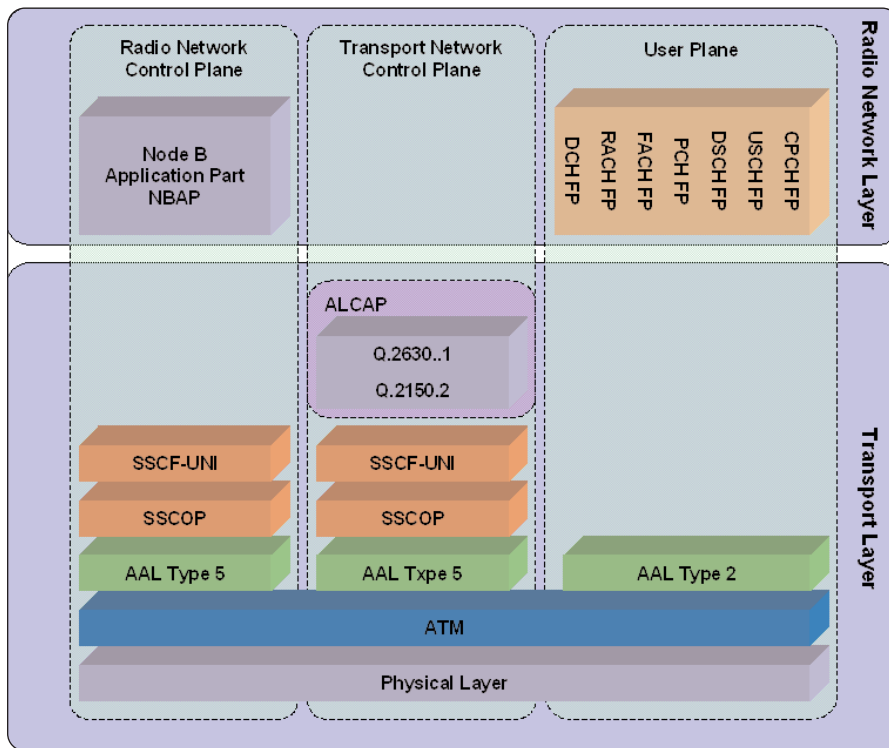
Figure 5 shows a K1297-G20 monitoring the Iub and the Iur interface.
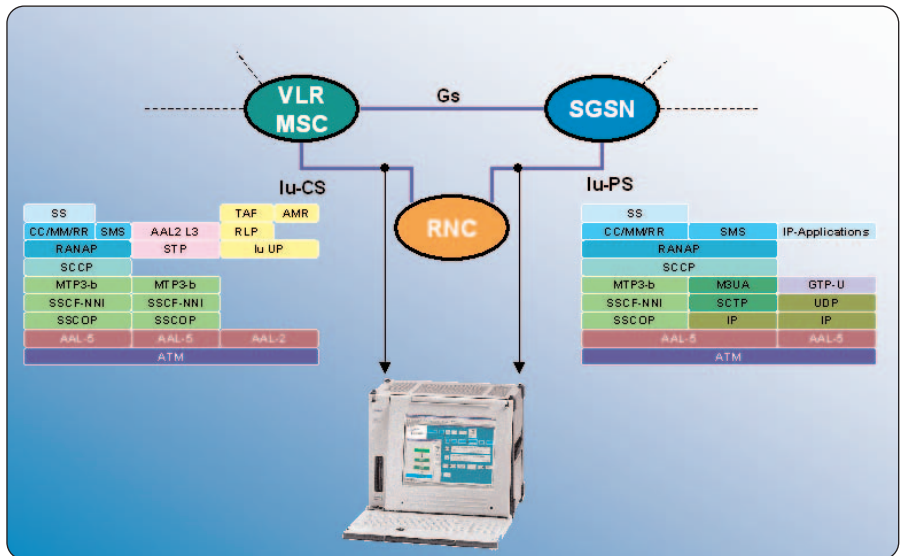
▶ **Figure 4.** *K1297-G20 monitoring the Iu interface.*
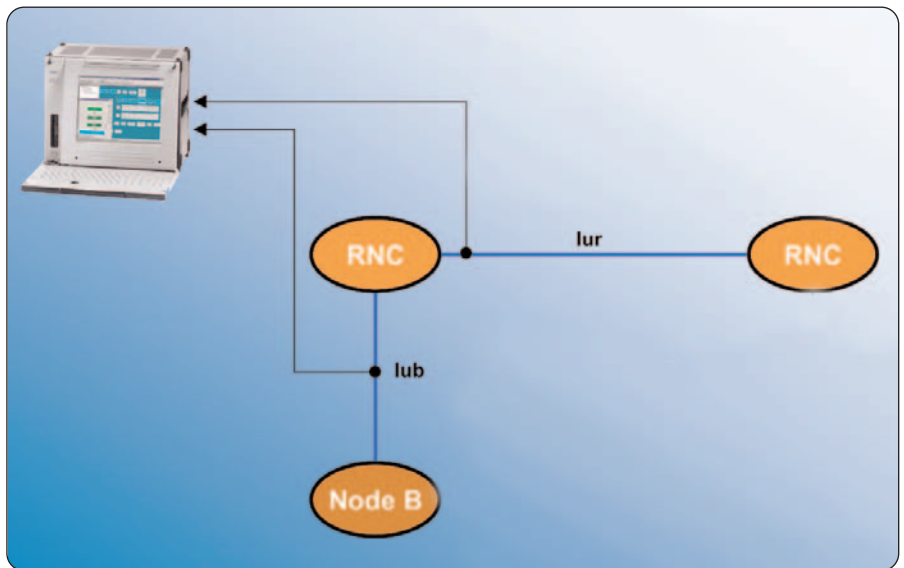
▶ **Figure 5.** *K1297-G20 monitoring of Iub and Iur interface.*

▶ **Figure 6.** *Iub interface protocol structure.*

▶ **Figure 7.** *Set of common transport channels.*

Dynamic allocation of AAL2 links with a K1297-G20 on a Iub interface

The Iub interface protocol architecture consists of two functional layers, as shown in Figure 6:
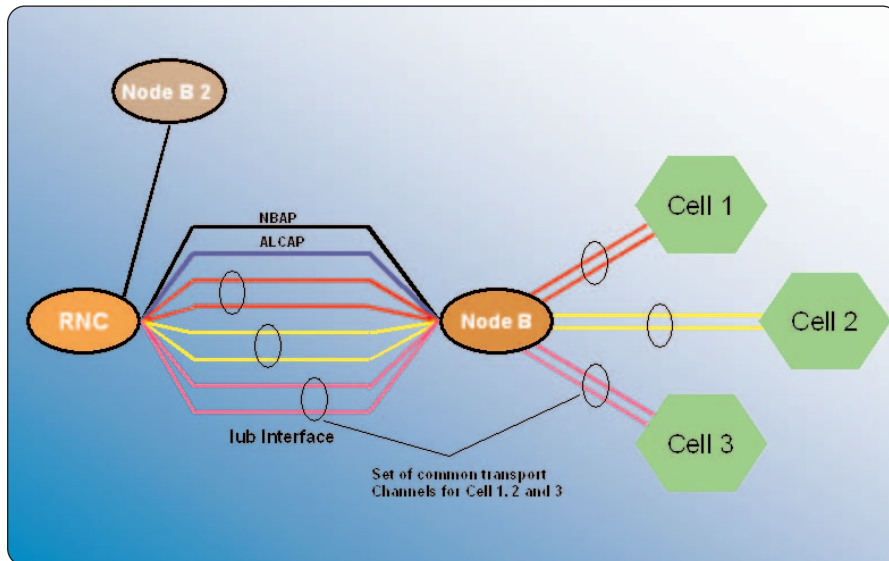
▶ The radio network layer defines procedures related to the operation of Node B. It consists of a radio network control plane and a radio network user plane

▶ The transport layer defines procedures for establishing physical connections between Node B and the RNC

In order to decode the dynamically opened Signaling Radio Bearers (Signaling RABs) from and towards the User Equipment (UE), the signaling on Iub Control Plane (NBAP) and Transport Network Control Plane (ALCAP) must be traced.

Each connected Node B requires configuring at least one pair of NBAP and ALCAP links.

An appropriate application analyzes this signaling, and opens the appropriate Common and Dedicated Control Channel.

One Node B serves a certain number of cells. For each cell there is a complete set of Common Control Channels, such as PCCH, BCCH, and CCCH. These channels are called Logical Channels. See Figure 7.

Seamless Access to IMA

The requirements for higher bandwidth and the need to reduce investments in mobile radio network infrastructure were the driving factors for the definition of IMA. The standard was defined in the late 1990s by the ATM Forum and describes how to use links with lower bandwidth (such as E1 and DS1) to form a "virtual" link with higher bandwidth.

In order to save costs during the early years of 3G network deployment, operators will try and re-use as much infrastructure from existing networks as possible by using this IMA technology. Using this technology successfully requires a tool for non-intrusive monitoring, which examines all lines without utilizing additional test equipment. By combining innate protocol monitoring for the Iub interface with seamless access to IMA links, Tektronix' innovative new IMA monitoring software enables users to perform upper-layer protocol analysis in addition to retrieving information (statistics, alarms, etc.) from the lower-layer IMA links. While most IMA monitoring tools actually interrupt physical lines carrying active network traffic (cutting off traffic on the link while the connection is being made), the new IMA solution is the only one to monitor passively.

Connection to the E1/DS1 lines of interest (those using IMA) is possible at any time without affecting live traffic. There is no need to disconnect or re-start the links being monitored. Tektronix' IMA software automatically determines whether the links that make up an IMA group are correctly connected. Links that do not belong in the group are revealed in real-time. This automation dramatically simplifies the task of connecting E1/DS1 cables and reduces the risk of incorrect connections. See Figure 9.
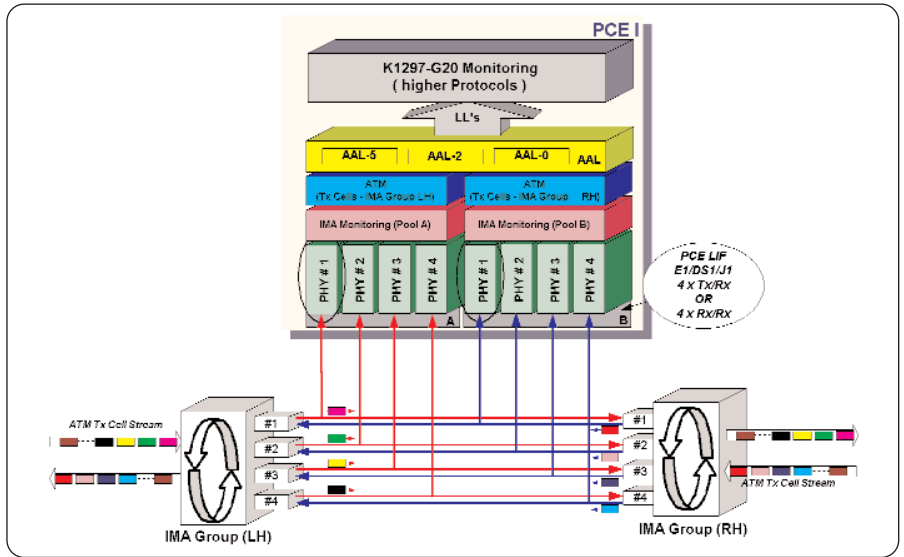
▶ *Figure 8.* G20 System Concept for passive IMA Monitoring.
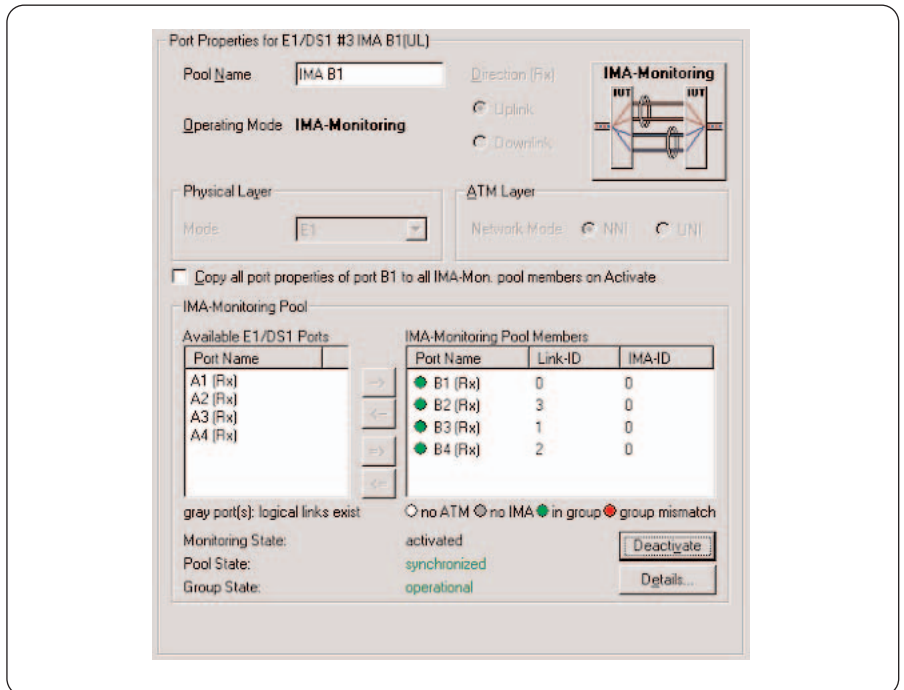
▶ *Figure 9.* An IMA Pool is correctly configured and the IMA Group is operational.

As soon as all cables are correctly connected to the PCM lines and the configuration is set up (IMA Pool is operational) all the higher protocol layers are decoded "as usual." Applications like Iub-Monitoring work as expected. In case of IMA state changes (e.g. add/remove of an IMA link) these events will be displayed as layer 1 alarms in the recording file. Furthermore there are dozens of IMA specific counters that allow a detailed analysis of the IMA protocol states.

► Ordering Information

Please refer to the new combined platform product summary for further information. Please note that in addition to the following ordering numbers upgrades are also available.

UMTS Bundling

7KK1269-6UM11 – UTRAN Monitor K1297-G20 with basic SW and Monitoring SW bundle for Iu, Iub, and Iur.

7KK1221-6SU11 – K1297-G20 SW Bundle Mon UMTS; (Iu-CS, Iu-PS, Iub, Iur); Prerequisite: Current System Version (7KK1220-0SCxx).

7KK1221-6SV11 – K1297-G20 SW Bundle Mon Mobile; (GSM, GPRS, and UMTS); Prerequisite: Current System Version (7KK1220-0SCxx).

UMTS Monitoring/Simulation/ Emulation Protocol Packages for K1297-G20

7PK1221-6UJ11 – K1297-G20 protocol SW Mon UMTS IMA Package; for PCE I E1/DS1 Line Interfaces only; Prerequisite: 7KK1200-3CCxx OR 7KK1200-3CDxx), K12xx System Version > 2.50.

7PK1221-7UN11 – K1297-G20 Protocol SW Mon/Sim/Emu UMTS Package; Iu-BC: SABP (TS25.419); Prerequisite: Current System Version (7KK1220-0SCxx) and 7PK1221-7TP11.

7PK1221-7MS11 – K1297-G20 Protocol SW Mon/Sim/Emu Mobile SMS Package; SMS (TS 24.011, TS23.040, GSM 03.40, GSM 04.11, and IS637 CDMA); Prerequisite: Current System Version (7KK1220-0SCxx) and 7PK1221-7MG11 or -7MC11 or -7MM11 or -7GB11 or -7UZ11.

7PK1221-7UQ11 – K1297-G20 Protocol SW Mon/Sim/Emu UMTS Package; Supplementary Services (TS24.080); Prerequisite: Current System Version (7KK1220-0SCxx) and 7PK1221-7UY11.

7PK1221-7UR11 – K1297-G20 Protocol SW Mon/Sim/Emu UMTS Package; RRC (TS25.331); Prerequisite: Current System Version (7KK1220-0SCxx) and 7PK1221-7TA11.

7PK1221-7UT11 – K1297-G20 Protocol SW Mon/Sim/Emu UMTS Iu, Iub, Iur Package; AAL2 Layer 3 (Q.2630.1), STC (Q.2150.1, Q.2150.2); Prerequisite: Current System Version (7KK1220-0SCxx) and 7PK1221-7TB11.

7PK1221-7UU11 – K1297-G20 prot. SW Mon/Sim/Emu UMTS Iub/Iur User Plane Package; PDCP (TS25.323); Prerequisite: Current System Version (7KK1220-0SCxx) & 7PK1221-7TA11.

7PK1221-7UV11 – K1297-G20 Protocol SW Mon/Sim/Emu UMTS Iub Package; NBAP (TS25.433); Prerequisite: Current System Version (7KK1220-0SCxx) and 7PK1221-7TB11.

7PK1221-7UW11 – K1297-G20 Protocol SW Mon/Sim/Emu UMTS Iur Package; RNSAP (TS25.423); Prerequisite: Current System Version (7KK1220-0SCxx) and 7PK1221-7TC11.

7PK1221-7UX11 – K1297-G20 Protocol SW Mon/Sim/Emu UMTS Iu CS User Plane Package; Iu UP (TS25.415); Prerequisite: Current System Version (7KK1220-0SCxx) and 7KK1220-0SL and 7PK1221-7UT.

7PK1221-7UY11 – K1297-G20 Protocol SW Mon/Sim/Emu UMTS Package; Iu, Iub, Iur Control Plane: MM/CC/SM/GMM/RR (TS24.008); Prerequisite: Current System Version (7KK1220-0SCxx) and 7PK1221-7UZ11 or 7PK1221-7UR11.

7PK1221-7UZ11 – K1297-G20 Protocol SW Mon/Sim/Emu UMTS Iu-CS/PS Control Plane Package; RANAP (TS25.413); Prerequisite: Current System Version (7KK1220-0SCxx) and 7PK1221-7TC11.

7PK1221-7GN11 – K1297-G20 Protocol SW Mon/Sim/Emu 2.5G and 3G Mobile G_n, G_p, G_a, Iu-PS Package; GTP (GSM09.60; TS29.060); Prerequisite: Current System Version (7KK1220-0SCxx) and 7PK1221-7TP11.

7KK1226-9GA11 – K1297-G20 Traffic Generation 2.5G and 3G Mobile G_n, G_b, G_i, Iu-PS; IP Packet generator and comparator; IP-Gate; Prerequisite: Current System Version (7KK1220-0SCxx) and 7PK1221-7TP11.

7KK1226-9GJ11 – K1297-G20 Traffic Generation 2.5G and 3G Mobile G_n, G_b, G_i, Iu-PS; IPv6 Packet generator and comparator; IPv6-Gate; Prerequisite: Current System Version (7KK1220-0SCxx) and 7PK1221-7TP11.

7PK1221-7MP11 – K1297-G20 prot. SW Mon/Sim/Emu 2G, 2.5G, and 3G Mobile CAP Package; incl. CAP Phase III (TS29.078); Prerequisite: Current System Version (7KK1220-0SCxx) and 7PK1221-7TC11.

7PK1221-7GX11 – K1297-G20 prot. SW Mon/Sim/Emu GPRS Gb-IP Package; incl. NS (3GPP TS 48.016); Prerequisite: Current System Version (7KK1220-0SCxx) & 7PK1221-7GB11.

IP Monitoring/Simulation/ Emulation Protocol Packages for K1297-G20

7PK1221-7JS11 – K1297-G20 Protocol SW Mon/Sim/Emu IPS7 Package; M3UA, SCTP; Prerequisite: Current System Version (7KK1220-0SCxx) and 7PK1221-7TP11.

Transport Monitoring/ Simulation/Emulation Protocol Packages for K1297-G20

7PK1221-7TA11 – K1297-G20 Protocol SW Mon/Sim/Emu Transport ATM AAL2 Package; UP FP (TS25.427, TS25.435), MAC (TS25.321), RLC (TS25.322); Prerequisite: Current System Version (7KK1220-0SCxx) and ATM HW: 7KK1200-3Cxxx, ≥8 links license.

7PK1221-7TB11 – K1297-G20 Protocol SW Mon/Sim/Emu Transport Broadband Package; incl. SSCOP (Q.2110), SSCF-UNI (Q.2130), SSCF-NNI (Q.2140), MTPL3b (Q.2210); Prerequisite: Current System Version (7KK1220-0SCxx) and ATM hardware; ≥8 link license.

7PK1221-7TC11 – K1297-G20 Protocol SW Mon/Sim/Emu Transport SCCP Package; incl. SCCP/SCMG; TCAP; OMAP; Prerequisite: Current System Version (7KK1220-0SCxx) and 7PK1221-7TN11 or 7PK1221-7TB11 or 7PK1221-7JS11.

7PK1221-7TP11 – K1297-G20 Protocol SW Mon/Sim/Emu Transport Packet Data Package; incl. X.25, LAP B, FR, IPv4, ARP/RARP, TCP and UDP, ICMP, IEEE802.3 MAC; Prerequisite: Current System Version (7KK1220-0SCxx) and Ethernet or ATM or PRIME Board.

7PK1221-7TJ11 – K1297-G20 Protocol SW Emu Transport Packet Data Package; incl. IPv6, ICMP (RFC2461, 2462 ,2463); Prerequisite: current system version (7KK1220-0SCxx) & 7KK1221-7TP and Ethernet or ATM or PRIME Board.

UMTS Conformance Tests for K1297-G20

7KK1226-8UP11 – K1297-G20 Tests for Conformance UMTS ALCAP; AAL2 Layer 3 (Q.2630.1) Conformance Test Suite and STC (Q.2150.1 and Q.2510.2) Emulation; Prerequisite: Current System Version (7KK1220-0SCxx) and 7PK1221-7TB11 and -6UT11 and 7KK1229-9TE11.

7KK1226-8GM11 – K1297-G20 Tests for Conformance UMTS Iu-PS; GMM/SM (TS24.008) towards SGSN; Prerequisite: Current System Version (7KK1220-0SCxx) and 7PK1221-7UZ, -7UY, -7TB, and 7KK1229-9TE.

7KK1226-8UG11 – K1297-G20 Tests for Conformance Broadband; SSCOP (Q.2110) and SSCF (Q.2140); Prerequisite: Current System Version (7KK1220-0SCxx) and 7PK1221-6/7TB11 and 7KK1229-9TE11.

7KK1226-8TB11 – K1297-G20 Tests for Conformance Broadband; MTP3b (Q.2210); Prerequisite: Current System Version (7KK1220-0SCxx) and 7PK1221-7TB11 and 7KK1229-9TE11.

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