Agilent
E6910A GSM/GPRS Protocol Application

Data Sheet

For the E6900A Wireless Protocol Test Set

Get your wireless devices to market faster and increase profitability sooner

The E6910A gives software engineers a network emulator on their bench, to quickly troubleshoot and validate GSM/GPRS wireless device designs. The flexible, comprehensive protocol analysis and data channel of the test set provide the tools needed to accurately evaluate and verify a device's signaling functionality, IP performance, and user experience. These enhanced capabilities make the E6900A test set one of the most advanced instruments available today.

Right at your bench...

- Accelerate your development schedule within minutes of power-up – troubleshoot and verify GSM/GPRS signaling features
- Produce higher quality designs with the ability to stress and measure the performance of your wireless device's Internet Protocol (IP) data channel using the real-time air-to-LAN functionality
- Quickly minimize the need to create custom debug code or to build elaborate triggering-hardware
- Breakthrough price and performance

The E6910A's powerful and full-featured protocol analysis capabilities include:

- Real-time logging of inter-layer and peer-to-peer messages including developer's proprietary messages (raw data only)
- IP datagram capture and display
- Selectable and powerful triggering, filtering, and search capabilities of logs
- The traffic overview summarizing logged message information
- Decode view for viewing individual bit fields with appropriate labeling for each message

IP data channels

As part of the troubleshooting strategy, the IP data channel feature allows you to originate and terminate real-time application-specific GSM/GPRS data traffic. A true IP data channel is supported to provide connectivity between the GSM/GPRS air interface and the LAN port on this instrument The throughput is controlled by the user's selection of slot and coding configuration. This capability enables testing and performance characterization for both the device's data handling and embedded applications like:

- FTP file transfers with local and remote servers
- Interoperability with real gateways and sites for WAP and other standards while surfing local intranet and external Internet sites
- Measure data throughput on the wireless device for both simple cases and under loaded or stressed datacomm conditions

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Overview of the E6910A GSM/GPRS protocol application

- Advanced protocol logging with the GPRS Wireless Protocol Advisor
- IP data connection for transfer of data between a device under test and a network
- Mobile-originated and mobile-terminated point-to-point GSM and GPRS short message service (SMS)
- Cell broadcast SMS
- Protocol event trigger outputs
- PBCCH and support for 8-bit or 11-bit PRACH
- Enhanced control of RLC/MAC, LLC, GMM and SM protocol events
- No RF parametric measurements
- All signaling features from E1968A GSM/GPRS mobile test application such as:
  - Multislot configurations for class 10 GPRS mobile devices
  - BLER, ETSI A and ETSI B data connection types
  - Mobile-reported BLER

Application	All lab integration, testing, and verification	Signaling and data channel protocol testing and verification	Manufacturing test
Software + Platform	**E6701C + E5515C**	**E6910A + E6900A**	**E1968A + E5515C**
Network emulation	●	●	●
Wireless protocol advisor	●	●	
RF-to-LAN IP data channel	●	●	
RF measurements	●		●
Calibrated RF performance	●		●

● Broad implementation
● Smaller and optimized implementation

GSM/GPRS wireless protocol advisor (WPA) logging software

WPA operating modes: real time or post capture

Demonstration mode: unlicensed, post-capture operation with viewing and analysis of demonstration log files provided with WPA

Traffic overview: single-line display of individual protocol messages in sequential order as received

- **Configurable display columns:** message number, message direction, system time, timestamp (based on PC's real-time clock), message name, repeat count and more based on individual field parameters

Decode view: display of detailed message contents

Display choices: individual octets of message or line per field of each parameter in the message

Configurable display columns: octet number, decimal value, binary value, hexadecimal value, field description (English)

Measurement setup view: graphical block diagram of logging software with indication of which triggers and filters are currently selected

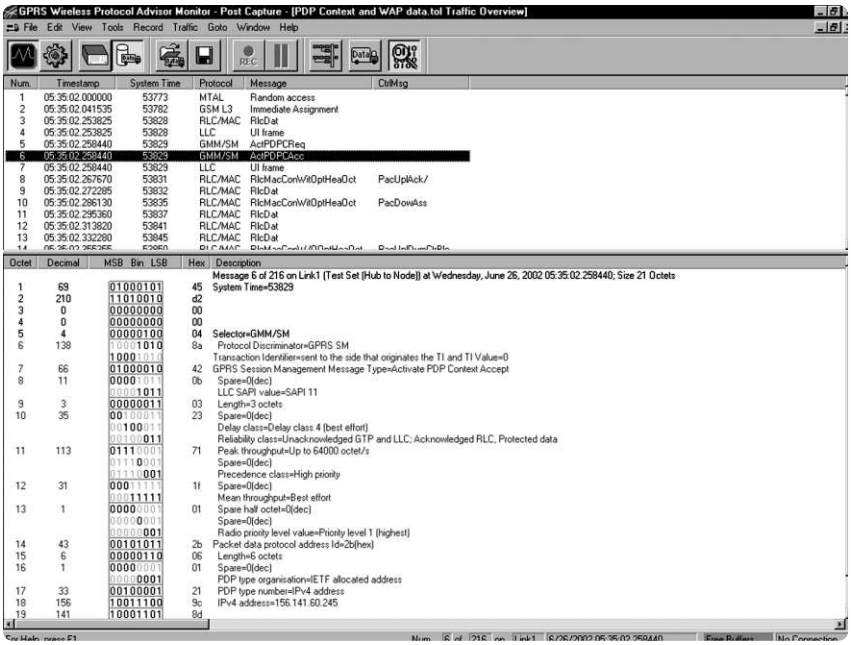

Figure 1. Use the Wireless Protocol Advisor to analyze test set and device protocol messages.

Filters: three types, all individually configurable by the user, which can be saved and recalled for later use.

- **Test set filters:** pass filters that limit the amount of information sent over the LAN with choices of MTAL, LAPDm, RLC/MAC, LLC, GMM/SM, SMS, GSML3, SNDCP, and TCP/IP
- **Log filters:** pass filters that limit the amount of information contained in the log. Extremely flexible user configurations based on individual field parameters of all layers. Filters can be combined using AND and OR operations.
- **View filters:** pass filters that limit the amount of information displayed, but do not affect the amount of information actually logged. Extremely flexible user configurations based on individual field parameters of all layers. Filters can be combined using AND and OR operations for each view used.

Triggers: user-configurable conditions that define when to start and stop logging. Triggers can be configured to pre-capture or post-capture a specific number of messages. Configurations can be saved and recalled for later use. Four types of trigger configurations are available.

- **Event trigger:** start or stop logging when message dropped, message received or received message overflow event occurs
- **Message match trigger:** start or stop logging when received message matches or does not match user-selected message or message parameter(s)
- **Time trigger:** start or stop logging on specific timestamp and day based on PC's real-time clock
- **Trigger counts:** number of start trigger occurrences before log capture begins

Requirements for optimal performance

- **Hardware requirements:** at least a Pentium® III 700 MHz PC with 128 Mbytes of memory, 500 Mbytes of free disk space and a TCP/IP LAN port
- **Supported operating systems:** English versions of Windows 98®, Windows NT® 4.0 (with at least service pack four), Windows 2000® or Windows XP®
- **Connection requirements:** 10 Mbit/sec 10 base T Ethernet (RJ-45 connector) using a crossover cable for direct connection to the PC or a standard cable through a switch or hub

IP data connection

- **Transfer of IP data between a device under test and a network with full PDP context activation**
- **Test your device's IP data functionality:** WAP or web browsing, FTP throughput rates with local or remote servers, serial or USB modem functionality, e-mail and data downloads to PC via data port
- **GSM circuit-switched and GPRS packet-switched connections**
- **Parameter changes during data transfer:** multislot configurations, coding schemes, power levels and channel numbers
- **Ping:** test set ping of device under test or other device on a network, network ping of test set or device

GSM circuit-switched (CS) data connection

- Mobile-originated establishment of a CS data connection at 2400, 4800 or 9600 bps using a full-rate GSM channel
- Transparent data (raw rate-adapted bits directly to PPP) at 2400, 4800 and 9600 bps
- Non-transparent data (using RLP layer) at 4800 and 9600 bps
- Full logging of layer 1, RLP, PPP and IP layers using WPA

GPRS packet-switched (PS) data connection

- Mobile-originated and mobile-terminated establishment of a PS data connection using multislot configurations for class 10 devices
- **GPRS class B:** page voice and SMS during an active GPRS data transfer
- **GPRS suspend and resume:** active GPRS data transfer suspended upon acceptance of voice or SMS request, then resumed after voice call or SMS is complete
- Full logging of Layer 1 through IP layer with WPA

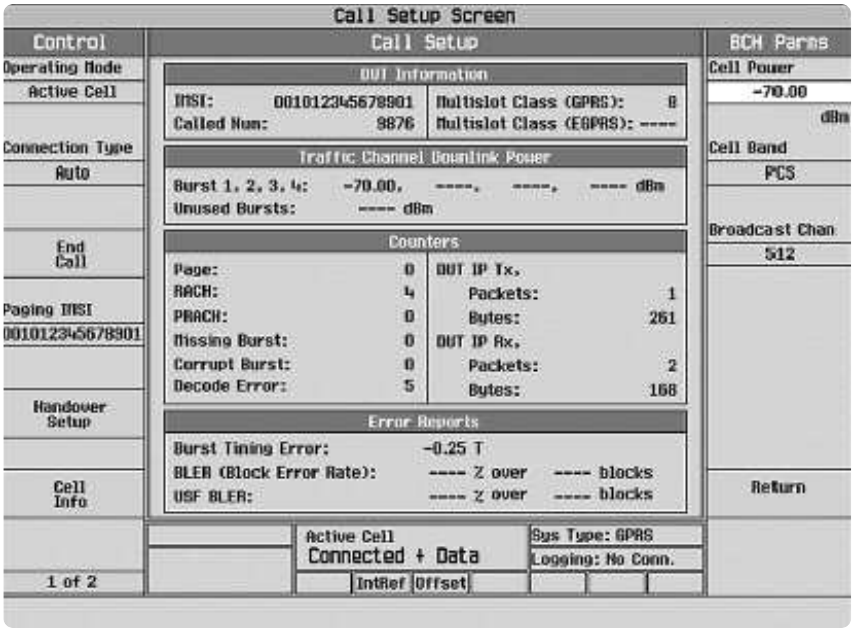

Figure 2. Test your device's Internet connectivity using CS data.

GSM and GPRS short message service (SMS)

- **GSM and GPRS point-to-point SMS:** mobile-originated, mobile-terminated, loopback of mobile-originated message back to the mobile as a new message, choice of 2 fixed-text messages or user-configurable message

  Fixed message 1: 0123456789ABCDEFGHIJKLMN OPQRSTUVWXYZabcdefghijklmn opqrstuvwxyz

  Fixed message 2: Agilent Technologies, your partner in wireless solutions.

- **Cell broadcast SMS:** send up to 3 messages simultaneously with settable channel, message code update number and language, choice of 2 fixed-text messages or user-configurable message

  Fixed message 1: The quick brown fox jumps over the lazy dog

  Fixed message 2: This instrument provides functional testing of broadcast SMS by sending up to three broadcast messages to the device under test. Two fixed messages and a user-defined message are available for selection. The second fixed message spans multiple pages.

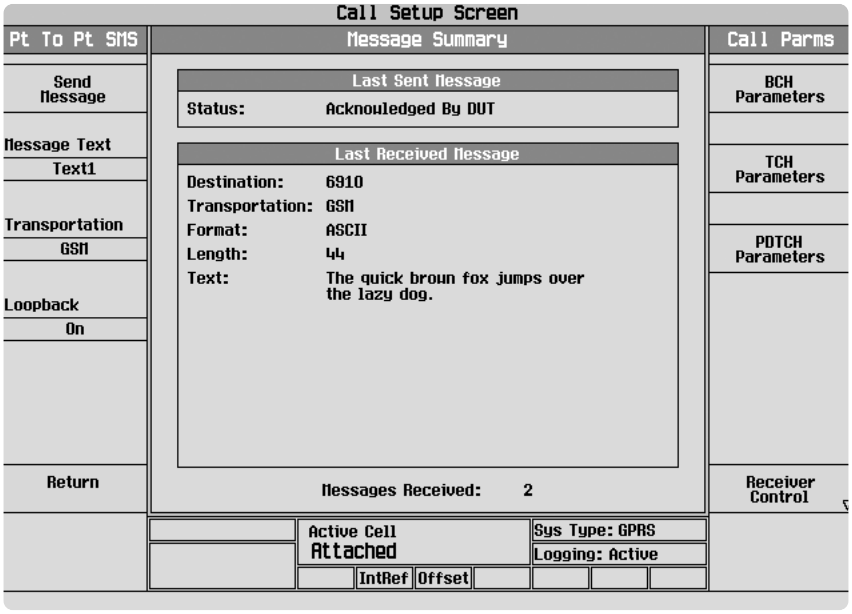

Figure 3. Test GSM and GPRS point-to-point SMS messages that you send and receive with your wireless device.

Trigger output functionality

- **Frame trigger outputs:** any combination of every frame, every frame except idle frames, every radio block, every BCH multiframe, every PDTCH multiframe or on a specific frame number (once per hyperframe).
- **Protocol event trigger output timing:** protocol events associated with an MS action can provide a trigger when the BS event occurs, when the MS is expected to receive or when the MS is expected to transmit.
- **RLC/RR layer protocol event trigger outputs:** any combination of Packet Uplink Assignment, Packet Downlink Assignment, Packet Timeslot Reconfigure, Packet Power Control and Timing Advance and Packet Immediate Assignment messages
- **Upper layer protocol event trigger outputs:** any combination of Identity Request, Attach Accept, Detach Request, Request PDP Context Activation and PDP Context Activation Accept messages

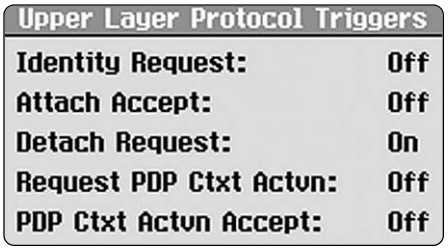

Figure 4. Upper layer protocol event trigger outputs are hardware triggers that help you to synchronize protocol events with measurements.

E-OTD functionality

- Partially customizable RRLP layer
- Configure and send Measure Position Request and Assistance Data messages from the test set
- Ensure Assistance Data messages are acknowledged by the device under test (DUT)
- Receive and display RRLP Protocol Error messages
- Retrieve parameters from the last Measure Position Response message from the (DUT)
- GPIB access only
- The ESG series of RF signal generators and E4406A VSA transmitter tester also have E-OTD functionality that can be used with the 8960 test set
- Application note available at **www.agilent.com/find/wirelessprotocol**, literature number 5988-8458EN

GPRS call processing functionality

- **Frequency bands:** GSM 450 MHz, GSM 480 MHz, GSM 750 MHz, GSM 850 MHz, RGSM 900 MHz, PGSM 900 MHz, EGSM 900 MHz, DCS 1800 MHz, PCS 1900 MHz
- **Coding schemes:** CS-1, CS-2, CS-3 and CS-4
- **Multislot configurations (downlink x uplink):** 1x1, 2x1, 3x1, 4x1, 2x2, 3x2
- **Multislot classes supported:** 1 through 10
- **Control channels:** BCH on TS0 or BCH on TS0 and PBCH on TS1 on any ARFCN in any band
- **Broadcast channel configuration:** FCCH + SCH + BCCH + CCCH + SDCCH / 4(0-3) + SACCH / C4(0-3). BCCH SI13 indicates presence of PBCH.
- **Packet broadcast channel configuration:** PBCCH + PCCCH + PDTCH + PACCH + PTCCH. PDTCH, PACCH and PTCCH currently unused.
- **Downlink PDTCH:** one, two, three or four on the same PDTCH ARFCN with one or two PDTCH amplitudes settable between zero and 55 dB below BCH amplitude. Amplitudes in unused timeslots selectable as off, PRL one or PRL two.
- **Handovers between:** bands, channels, multislot configurations, power reduction reference level, MS levels on all bursts, USF values
- **Attach:** mobile-initiated
- **Detach:** mobile-initiated, network-initiated
- **Packet data transfers on uplink and downlink**
- **BA table:** 16 settable neighbor cells
- **Cell parameters:** settable MCC, MNC (including three-digit for PCS 1900 MHz band), LAC, RAC, NCC, BCC, PBCCH off or on, PBCCH choice of 8-bit or 11-bit PRACH
- **Loopback:** selection of which contiguous downlink bursts to loop back on the first uplink burst
- **Counters:** RACH or PRACH, IP packets and bytes transmitted and received by the DUT
- **Error reports:** USF BLER, BLER for all blocks and burst timing error
- **Measurement reports:** C value, Rx quality, signal variance and interference levels for each timeslot

Operating modes

Active cell: a BCH is generated on the downlink. Attach and detach procedures and packet data transfers on the uplink(s) and downlink(s) can be executed. Multislot configuration, coding scheme and downlink and uplink power level(s) can be changed. All transmitter measurements can be made. Four data connection types are available in active cell operating mode as follows.

- **Data connection type ETSI type A:** test mode A as defined in ETSI GSM 04.14. The downlink is terminated once the uplink has been established.
- **Data connection type ETSI type B:** test mode B as defined in ETSI GSM 04.14. Downlink PDTCH(s) data is generated and the mobile loops back the downlink data on the uplink(s). BER measurements can be made.
- **Data connection type BLER:** an Agilent-proprietary data connection with the primary purpose of making BLER measurements
- **Data connection type IP data:** an IP data connection that allows transfer of data in both directions between a device under test and an IP data network

GPRS test mode BCH: a BCH is generated on the downlink, but no uplink demodulation occurs.

GPRS test mode BCH + PDTCH(s): a BCH and PDTCH(s) are generated on the downlink and the downlink multislot configuration can be changed. A forced call can be established if the mobile is manually synchronized to the test set's downlink and the mobile's uplink PDTCH(s) uses the same ARFCN and time slot(s) as the downlink. When a forced call is established, BER measurements can be made and demodulation and channel decoding of the uplink are available, although no messages are decoded.

Off: all signaling operations, uplink demodulation and downlink generation are stopped and the RF generator output power is turned off. No external trigger is available.

RLC/MAC control functionality

- **Timing advance control:** settable value, continuous communication via PTCCH off or on
- **Allocation control:** medium access mode dynamic or fixed, user-settable USF value, user-settable maximum number of octets allocated
- **Handover control:** packet timeslot reconfigure off or on, packet power timing advance off or on
- **Block poll rate:** settable value from one to 32
- **Frame start position:** relative, absolute or immediate
- **RLC/MAC header:** off or on in GPRS BCH+PDTCH operating mode

LLC control functionality

- **FCS for BLER:** valid or corrupt
- **Payload patterns in ETSI B or for BLER with corrupt FCS:** all zeros, all ones, alternate bits, alternate pairs, alternate quads, PRBS-15, fixed 2B (hex), GMM info for BLER

GMM control functionality

- **Attach accept:** selectable GMM cause, reject IMSI for non-GPRS services off or on
- **Attach reject:** selectable GMM cause, reject all attach attempts off or on
- **Detach request:** selectable GMM cause
- **Identity request:** IMSI, IMEI, IMEISV, TMSI

SM control functionality

- **Activate PDP context accept:** override requested reliability class off or on with selectable value, selectable subscribed reliability class, includes acknowledged LLC
- **Activate PDP context reject:** selectable SM cause

Technical specifications

These specifications apply to the following hardware and software.

- E6900A mainframes
- E6910A protocol applications of firmware revision A.02

Specifications describe the test set's warranted performance and are valid over the entire operation and environmental ranges unless otherwise noted. All specifications are valid after a 30-minute warm-up period of continuous operation. Supplemental specifications are intended to provide additional information useful in applying the instrument by giving typical, but non-warranted performance parameters. These characteristics are shown in italics and labeled as "typical" or "supplemental" and apply at +25 °C.

Figure 5. The E6900A wireless protocol test set with the E6910A GPRS protocol application provide non-parametric signaling testing at an exceptional value.

RF generator specifications

RF frequency

Frequency ranges: 400 to 500 MHz, 680 to 1000 MHz, 1.7 to 2.2 GHz

Setting resolution: *1 Hz*

Accuracy and stability: Same as timebase reference

RF amplitude

Output level range: –90 to –20 dBm

Absolute output level accuracy: < ±4.0 dB

Output level setting resolution: *0.1 dB*

Typical VSWR: *< 1.3:1*

Reverse power: < 2.5 W continuous, < 5 W peak bursted power

GMSK signal generation

Multislot level range: 2 levels ≤ 20 dB different between –90 and –70 dBm

Absolute output level accuracy with GMSK modulation on: < ±4.0 dB for single slot and multislot signals

Peak phase error: < ±8 degrees

rms phase error: < 2 degrees

Frequency error: < ±0.05 ppm

Demodulation receiver specifications

Frequency capture range: signal must be within ±200 Hz of test set's expected frequency for warranted performance

Maximum input level: ≤ +35 dBm

Typical single-slot demodulation sensitivity: *≥ –30 dBm for maintaining a data link*

Typical multislot demodulation sensitivity: *all uplink time slots ≥ –30 dBm for maintaining a data link when adjacent time slots are ≤ 20 dB different in level*

Timebase specifications

Internal high-stability 10 MHz oven-controlled crystal oscillator (OCXO)

Aging rates: < ±0.01 ppm per year, < ±0.005 ppm peak-to-peak per day during any 24-hour period starting 24 hours or more after a cold start

Temperature stability: < ±0.01 ppm frequency variation from +25 °C over the temperature range 0 to +55 °C

Warm-up times: Five minutes to be within ±0.1 ppm of frequency at one hour, 15 minutes to be within ±0.01 ppm of frequency at one hour

Typical accuracy is derived from: *±[(time since last calibration) x (aging rate) + (temperature stability) + (accuracy of calibration)] after a 30-minute warm-up period of continuous operation*

Typical initial adjustment: *±0.03 ppm*

External reference input

Input frequency: 10 MHz

Input frequency range: *< ±5 ppm of nominal reference frequency*

Input level range: *0 to +13 dBm*

Input impedance: *50 Ω nominal*

External reference output

Output frequency: same as timebase reference (internal 10 MHz OCXO or external reference input)

Typical output level: *≥ 0.5 V rms*

Output impedance: *50 Ω nominal*

Remote programming

GPIB: IEEE standard 488.2

Remote front panel lockout: allows remote user to disable the front panel display to improve GPIB measurement speed

Functions implemented: T6, TE0, L4, LE0, SH1, AH1, RL1, SR1, PP0, DC1, DT0, C0, E2

General specifications

Dimensions (H x W x D): 8.75 x 16.75 x 24.63 inches (222 x 426 x 625 mm)

Weight: 62 lbs. (28.2 kg)

Display: 10.5 inches (26.7 cm), active matrix, color and liquid crystal

Local area network (LAN) port: RJ-45 connector, 10 Base T Ethernet with TCP/IP support

Operating temperature: 0 to +55 °C

Storage temperature: –20 to +70 °C

Power: 88 to 135 VAC, 193 to 269 VAC, 50 to 60 Hz, 450 VA maximum

Typical power consumption: *300 to 350 W continuous*

Calibration interval: two years

EMI: conducted and radiated interference meets CISPR-11, susceptibility meets IEC 1000-4-2, 1000-4-3 and 1000-4-4

Test subscriber identification module (SIM) cards

Test SIM cards are available for purchase from Agilent. Two types are available as follows.

- **Programmed SIM card micro-size:** fits most current wireless devices (about 15 x 25 mm), part number 08922-61887
- **Programmed SIM card standard:** rarely used in current phones, fits older, large phones (about the size of a credit card), part number 08922-80047

Ordering information

For the most up-to-date ordering information, please visit the Agilent web site at: **www.agilent.com/find/wirelessprotocol**

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