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# Agilent Technologies

## Internet Advisor - ATM/WAN

Technical Specification


ATM/WAN Testing Made Easy..... page 2
Key ATM Features and Functionality..... page 2
Key WAN Features and Functionality..... page 3
Key General Features and Functionality.... page 3
LAN over WAN, and LAN (over WAN)..... page 3
over ATM
Aquisition Systems..... page 5
Dual Simultaneous Analysis..... page 6
ATM Testing..... page 7
WAN Testing..... page 19
Frame Relay..... page 20
ISDN..... page 30
X.25..... page 30
PPP (Point to Point Protocol)..... page 36
SMDS (Optional)..... page 36
ATM DXI..... page 36
V5.1/V5.2 Monitoring..... page 36
Physical Layer..... page 36
BERT (Bit Error Rate Testing)..... page 38
ATM and WAN Interface Specifications.... page 40
Remote Operation..... page 55
General Specifications..... page 55


### Solve Complex Internetworking Problems the First Time

The Agilent Internet Advisor is a Tool for Today's Field Service Network Managers, Engineers, and Technicians for the Deployment, Troubleshooting, and Optimization of Today's Advanced, Frame-and Cell-based Networks with Mission-Critical Applications.

The Internet Advisor is the most complete LAN, WAN and ATM tool for Installation, Maintenance and Troubleshooting. The Internet Advisor lets you connect anywhere on the network and capture all the necessary data to give you complete visibility into the Network. This specification covers the ATM and WAN aspects of the Internet Advisor release 11.3, unless otherwise specified; see also the LAN specification.

No other portable analyzer offers statistical performance measurements; monitor and decode LAN, LAN over WAN, LAN over ATM, and WAN over ATM protocols in real-time and post processing analysis; traffic generation, simulation and emulation; stimulus and response tests; Bit error rate testing, and more, under a single handle solution.

The Internet Advisor combines complete protocol analysis for ATM, WAN and LAN testing with a powerful and robust personal computer. Although the analyzer is PC-based, it does no rely on the PC for its data capture performance; separate acquisition hardware ensures 100 percent full-duplex capture at speeds from 50 bps up to 1,000 Mbps.

In addition to all this, any two of the LAN, WAN or ATM applications can be run simultaneously allowing interworking analysis to be performed.

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## ATM/WAN Testing Made Easy

To install or troubleshoot an ATM or WAN link, you need to test for many things: physical errors, equipment interoperability, ATM cell congestion, and even LAN traffic problems. The Internet Advisor offers integrated ATM, WAN, and LAN protocol analysis capabilities, along with bit error rate testing (BERT), stimulus/response measurements, and statistical analysis capability - everything you require to get a good look at the physical layer, ATM/MAC layer, and all the protocol layers above.

In addition to all of the above, the Internet Advisor can test ATM quality of service (QoS) with contract conformant traffic and can check live traffic for conformance to a traffic contract (policing).

No matter what the traffic level, the Internet Advisor will capture every cell or frame on your full-duplex network connections. It monitors non-intrusively and decodes ATM or WAN data at full line rate. In addition, it can simulate either direction of a line under test and process previously captured data from its capture buffers or from a file for retransmission. The analyzer doesn't just capture traffic when the network is working - it gives you information when the network is broken - when you need it the most.

## Key ATM Features and Functionality

The Agilent Internet Advisor provides the following powerful ATM features and functions:

Handles ATM testing rates from 1.5 Mbps to 622 Mbps; ATM Interfaces including T1, E1, J2, E3/DS3, STM-1/OC-3c, STM-4c/OC-12c, ATM25 (25.6 Mbps UTP-3/5) and 155 Mbps UTP-5 are available as plug-in modules or undercradles
Analyses protocols including full rate capture with capture and display filtering and searching (e.g. set the capture filter to capture only ATM streams carrying IP traffic with specific IP addresses)
Monitors, captures data, and decodes upper and lower layer protocols in real time
Decodes and logs statistics for LAN encapsulated protocols over ATM, including (optional) Voice over IP decodes: H.323 series, IETF series (SIP, MGCP, SGCP, MEGACO), ITU-T T.38
Finds Errors in capture file or buffer
Decodes AAL-1, AAL-2, AAL-3/4, AAL-5
Decodes Frame Relay over ATM
Decodes ATM UNI, NNI (B-ISUP, B-ICI) and PNNI signaling
Real-time and post-processing User Assisted LAN over ATM
Emulates ATM UNI signaling – check call set-up procedures
Emulates ELAN Join (LANE)
Generates user-defined cell traffic from a cell table
Retransmits captured traffic which has been copied and pasted to the cell table, modified (e.g. VPI-VCI and/or embedded IP addresses changed); the HEC and AAL-5 CRC-32 are automatically recalculated
Generates ATM ICMP Echo (PING)
Generates and analyses OAM cells
Tests ATM QoS performance to the ITU-T O.191 standard – measures cell loss, cell delay, cell delay variation, cell misinsertion, cell errors
Generates ATM traffic shaped to traffic contracts
Polices ATM traffic to traffic contracts
Tests simultaneously on two different or similar ATM interfaces
Tests simultaneously with other technologies (e.g. Frame Relay, Ethernet)
Tests physical frame layer and cell layer bit error rates (BER)
Measures optical power
Pulse amplitude measurement on STM-1e



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## Key WAN Features and Functionality

The Agilent Technologies Internet Advisor provides the following powerful wide area network (WAN) features and functions:

WAN testing speeds from 50 bps to 52 Mbps

Built-in all major WAN interfaces into the instrument mainframe, including V.10/V.11, V.24/V.28/RS-232C, V.35, V.36/RS-449/422/423/530, X.21

Interfaces, including ISDN Basic Rate Interfaces (BRI) S/T/U and Primary Rate Interfaces (PRI), E3/DS3 Cells and Frames, E1/T1, HSSI, DDS 4-wire, are available as slide-in modules

Full-featured testing capability for all common WAN technologies, including Frame Relay, PPP (Sync, Async), ISDN, X.25, HDLC, SMDS, SNA, Async, Bisync, ATM DXI, and more

Monitoring, data capturing, and decoding for upper and lower layer protocols in real time

Decodes and logs statistics for LAN encapsulated protocols over WAN, including (optional) Voice over IP decodes: H.323 series, IETF series (SIP, MGCP, SGCP, MEGACO), ITU-T T.38

Real-time and post-processing User Assisted LAN over Frame Relay and HDLC capture/display filtering and searching

Find Error in capture file or buffer

Comprehensive bit error rate testing (BERT)

Frame Relay analysis Voice and Fax over Frame Relay (FRF.11) decodes

Auto LMI detection and decoding for ANSI, ITU-T or original LMI

Auto LAN encapsulation over Frame Relay detection for RFC 1490/2427, Ethertype, FRF3.1

Tests simultaneously on two different or similar WAN interfaces

Tests simultaneously with other technologies (e.g. ATM, Ethernet)

Pulse amplitude measurement on E3 and DS3

## Key General Features and Functionality

Other technologies covered include 10/100 Ethernet, Gigabit Ethernet, Token Ring, FDDI, RTP QoS, VoIP and more

LAN/WAN/ATM/IP under one handle

Real-time counters and triggers, with logging and CSV export capabilities of statistics to disk

Line-status monitoring

Commentators

Absolute, Delta and Relative Time

User bytes (skip bytes between layers)

Enhanced decode view with HEX to detail correlation

True multi-tasking capability with user friendly full 32 bit Microsoft Windows® user interface, so that monitoring, decoding, statistical analysis, and stimulus/response tests can be executed simultaneously

Context-sensitive on-line Help with measurement and troubleshooting guides, acronym list, index and glossary

Agilent Software Upgrade Subscription Service to keep you up-to-date on the latest software enhancements

Highly portable economical package featuring a rugged based PC with full keyboard, large active color display and pointing device

## LAN over WAN, and LAN (over WAN) over ATM

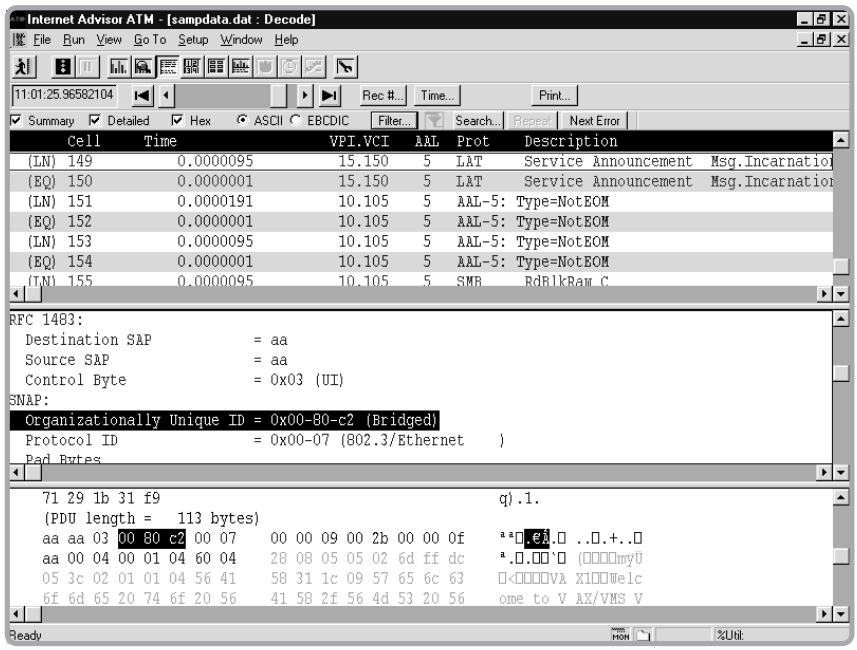
Encapsulated LAN data is automatically extracted and decoded by the Internet Advisor including complex encapsulated protocols. For unique encapsulation schemes, the user may specify the offset as well. Nearly 300 decodes exist for layer 3 and above; these are common to all underlying technologies (LAN, WAN and ATM).



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The Internet Advisor provides an off-line LAN Expert Analysis tool. The off-line LAN Expert Analysis allows the user to examine Ethernet, Fast Ethernet, Gigabit Ethernet, ATM or WAN (HDLC or Frame Relay) encapsulated LAN frames on an Internet Advisor or personal PC without Internet Advisor hardware.
The comprehensive set of protocol decodes include all of today's popular Protocol Stacks:

- TCP/IP
- AppleTalk
- Banyan
- DECnet
- IBM/SNA
- Novell
- ISO
- SUN
- XNS
- Cisco
- 3Com
- Microsoft LAN Manager
- H.323 series, T.38
- SIP, MGCP, SGCP, MEGACO




## Commentators

Powerful "Commentators" follow state-based protocols and can provide warnings and alerts when unusual message sequences are detected.

## Real-Time Filtering

The Internet Advisor now offers real-time IP and WAN filtering at rates up to 155Mb/s. This allows the user to isolate and analyze LAN and Frame Relay traffic taking place on an ATM circuit or LAN traffic taking place on a Frame Relay circuit.

The real time filtering function gives users application-level, LAN-centric troubleshooting on their ATM or Frame Relay network, thus allowing them to see specific traffic types which may be causing trouble on the network. The user can even filter by IP source and/or destination address IP traffic which is encapsulated in Frame Relay which is, in turn, encapsulated in ATM. This feature maximizes valuable buffer space for optimal data collection of targeted LAN traffic since the filtering takes place before data capture.



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In addition to capture filtering, which is performed in hardware, the Internet Advisor is able to gather counts of events such as cells or frames which meet the filtering criteria. More details of these features is given in technology specific sections in this specification.

Powerful display (post-capture) filtering and search functionality allows the user to drill down further for troubleshooting purposes.

**Enhanced decode view**
The decode view is user configurable by 'right clicking' in the summary view. The decode view has a very user-friendly, 'one-line' and 'multi-line' read out in the summary view. It also offers "hex to detail mapping" - by highlighting an element in the detailed view, the corresponding hex element is highlighted in color in the 'Hex' section of the decodes. The reverse is also true.
The Internet Advisor also has powerful, user-configurable 100ns resolution time-stamp options as follows:

- **Delta** — shows the time interval between adjacent cells; gives another view into delay and delay variation of the cell traffic;

- **Relative** — shows the time difference between critical events and other cells in the traffic flow; for example, if a ping is considered time-zero, cells which arrived before or after will be time-stamped with their relative corresponding arrival time;

- **Absolute** — shows events timestamped with date and time of day.
The decode view now also offers color mapping of the protocol layers in the decode view; this allows each of the layers in the data flow to be color coordinated for easy identification, thus simplifying protocol analysis.

## Acquisition Systems

There are two acquisition systems for ATM and WAN: the J2300D Internet Advisor mainframe and the J2900A High Speed undercradle.

### J2300D Internet Advisor Mainframe

The J2300D mainframe comprises the acquisition system for all ATM and WAN plug-in modules plus the V series interfaces, connectors for which are present on the body of the mainframe.

In addition, the mainframe includes a full PC running the Microsoft® Windows98® operating system on a 300MHz processor, a built in keyboard with pointing device, a Super VGA active color display, dual PCMCIA card slots, stereo speakers and the usual printer and serial ports. The PC is used to control the mainframe acquisition system and the acquisition system in any attached undercradle, and to collect and post process results.

Note that the PC is not used for real-time processing of measurements – this is all done in the acquisition system and plug-in modules. This allows the PC to handle multiple tasks such as the Dual Simultaneous Analysis feature which involves the simultaneous control of the mainframe acquisition system and attached undercradles, as discussed later.

### J2900A High Speed Undercradle

The J2900A undercradle is similar in function to the J2300D mainframe except that it has no built in PC but relies upon the PC contained in the J2300D ATM/WAN or J3446D LAN mainframes to control it and to collect and post process results. It accepts all ATM and WAN plug-in modules.



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## Dual Simultaneous Analysis

The Internet Advisor has the ability to test at two different interfaces and technologies simultaneously, e.g. E1 Frame Relay and E3 ATM, DS3 Frame Relay and 10/100 Mbps Ethernet, ATM25 and OC-3c ATM, etc. This functionality allows the user to test interworking in mixed technology environments (see the Application Note 1346 for details on this kind of testing).

In order to perform dual simultaneous analysis, combinations of an Internet Advisor mainframe (J2300D or J3446D) and an undercradle (J3444A or J2900A) is required, the mainframe and undercradle being each supported by an application (LAN, WAN or ATM) running on the PC embedded in the mainframe. Note that the applications do not have to be different so, for example, a J2300D Internet Advisor mainframe fitted with a J2900A High Speed undercradle could each be fitted with the same type of ATM or WAN interface and be run simultaneously – e.g. two J3766A ATM25 interface modules.

The following table shows the combination of supported mainframes, undercradles, interfaces and technologies:

| | | | J2300D Mainframe | | | | | | | | | | J3446D Mainframe |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | WAN Only | | | | WAN/ATM | | | ATM Only | | | |
| | | | V Series | DDS4 Wire J2908A | HSSI J3762A/B | ISDN J2904B J2905B | T1 J2298B J2299B | E1 J2293B J2294B J2296B J2297B | E3/DS3 J3759A/B | ATM25 J3766A | STM-1/0C-3c J2912A/B | UTP155 J2913B | LAN Ethernet |
| J2300A Undercradle | WAN Only | DDS4 Wire J2908A | X | X | X | X | X | X | X | X | X | X | X |
| | | HSSI J3762A/B | X | X | X | X | X | X | X | X | X | X | X |
| | | ISDN J2904B J2905B | X | X | X | X | X | X | X | X | X | X | X |
| | WAN/ATM | T1 J2298B J2299B | X | X | X | X | X | X | X | X | X | X | X |
| | | E1 J2293B J2294B J2296B J2297B | X | X | X | X | X | X | X | X | X | X | X |
| | | E3/DS3 J3759A/B | X | X | X | X | X | X | No | X | X | X | X |
| | ATM Only | ATM25 J3766A | X | X | X | X | X | X | X | X | X | X | X |
| | | STM-1/OC-3c J2913B | X | X | X | X | X | X | X | X | X | X | X |
| LAN Undercradle | | UTP155 J2913B | X | X | X | X | X | X | X | X | X | X | X |
| | | Fast Ethernet J3444A | X | X | X | X | X | X | X | X | X | X | X |
| | | Ethernet J2306A | X | X | X | X | X | X | X | X | X | X | X |
| | | Token Ring J2307A | X | X | X | X | X | X | X | X | X | X | X |
| | | Ethernet/Token Ring J2309A/B | X | X | X | X | X | X | X | X | X | X | X |
| | | FDDI J2524A | X | X | X | X | X | X | X | X | X | X | X |

**Supported Hardware Configurations**

**Note:** The supported operating temperature range for running dual simultaneous analysis is 5° C to 30° C (41° F to 86° F).



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## ATM Testing

The Internet Advisor supports the following interface types for ATM Testing:

| | | |
|---|---|---|
| E1* | STM-4c | OC-12c |
| E3* | T1/DS1* | ATM25 |
| STM-1 | T3/DS3* | 155UTP |
| STM-1e** | OC-3c | J2*** |

* these interfaces also support WAN testing (see WAN Testing section)
** supported in the release of Internet Advisor software following 11.3
*** to special order – enquire for details

The following sub-sections deal with all layers of testing, starting at the higher layers and working down to the physical layer.

### Service Layer ATM Testing

**Decoding**
In addition to the nearly 300 encapsulated LAN decodes common to LAN, WAN and ATM in the Internet Advisor, ATM specific protocols decoded include:
LAN over Frame Relay (RFC 2427 / 1490) over ATM (FRF.5)
LAN over ATM (RFC 1483)
Classical IP and ARP over ATM (RFC 1577)
Ethernet and Token Ring LAN Emulation (ATM Forum LANE 1.0 & 2.0)
MPEG-2
UNI Signaling (ATM Forum UNI 3.0, 3.1, 4.0)
NNI Signalling (B-ISUP (ITU-T Q.2761 – Q.2764) and B-ICI)
ILMI (Integrated Local Management Interface)
ATM Forum PNNI 1.0 signaling and routing
IP Switching (Ipsilon):
- IFMP (RFC 1953)
- IFMP-C (RFC 1987)
- GSMP (RFC 1954)

Fore Switch Signaling: SPANS
ATM Forum MPOA
Newbridge VIVID (MPOA)

**Simulation**
The Internet Advisor is able to simulate higher layer traffic either by the use of pre-defined messages, e.g. ATM encapsulated ICMP-echo (PING), through the development of user defined cell sequences or, more conveniently, by copying and pasting previously captured traffic to the cell table and editing it, as appropriate (see ATM Cell Generation in a later section).



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## ATM Adaptation Layer (AAL)

The Internet Advisor provides decodes for AAL-1 through AAL-5. Recently added are the decodes for AAL-2 Common Part Sublayer (AAL-2 CPS to ITU-T I.363.2) and AAL-2 Service Specific Segmentation and Reassembly sublayer (AAL-2 SSSAR to ITU-T I.366.1). Note: AAL-1 & AAL-2 decodes are not currently supported at 622 Mbps.

### AAL-1

| **Fields decoded:** | **Errors detected and displayed:** |
|---|---|
| CSI | ATM SDU not 48 bytes long |
| Sequence number | Invalid sequence number |
| CRC | Invalid parity |
| Parity | Invalid CRC-3 |

### AAL-2




### CPS (Common Part Sublayer)

| **Fields decoded:** | **Errors detected and displayed:** |
|---|---|
| CPS-PDU start field (STF) | STF Parity error |
| - OSF (Offset field) | STF Sequence number error |
| - SN (Sequence number) | Number of octets expected in the CPS packet does not match with the STF field |
| - P (Parity) | Error in the OSF value (>=48) |
| CPS-Packet (one or more) | Error in HEC |
| CPS- Packet Header (CPS-PH) | Length of received packet is incorrect. |
| - CID Channel identifier | Errors in reassembly |
| - LI Length Indicator | Invalid value in UUI |
| - UUI (User to user indication) | |
| - HEC | |
| CPS-Packet Payload (CPS-PP) | |
| CPS-INFO | |
| Padding | |



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### SSTED (Service Specific Transmission Error Detection) Sublayer

**Fields decoded:**
SSTED-PDU Payload
SSTED-PDU Trailer
- SSTED-UU (User-User indication)
- Reserved
- CI (Congestion Indication)
- LP (Loss Priority)
- Length
- CRC

**Errors detected and displayed:**
SSTED-PDU of length 8 or less has been received
Incorrect length value of the SSTED-PDU
Error in CRC

Note: The AAL-2 Service Specific Segmentation and Reassembly (SSSAR) sublayer has, of course, been implemented below the SSTED sublayer but its decode is not shown explicitly (the SSTED layer decode is sufficient)

## AAL-3/4

**Fields decoded:**
Reassembly of segments for upper layer decoding
Decode of CPCS layer (CS-PDU)
Check for segmentation errors in the decode, such as:

- Missing BOM or EOM
- Btag/Etag mismatch
- Check and flag of CRC-10 errors:
  - MID
  - BOM
  - COM
  - EOM
  - Btag
  - Etag

**Errors detected and displayed:**
ATM SDU not 48 bytes long
Invalid SAR sequence number
Invalid SAR length indicator
Invalid SAR CRCR protocol simulation
CPCS common part indicator = 0
CPCS buffer allocation size is less than the actual data size
CPCS begin tag = end tag
CPCS length is larger than the buffer allocation size
SAR payload length is less than the CPCS header length
SAR Payload length is less than CPCS trailer length

## AAL-5

**Fields decoded:**
Re-assembly of segments for upper layer
Decode of CPCS layer (CS-PDU)
Check and flag of CRC-32 errors
Display filtering on SDU type

**Errors detected and displayed:**
ATM SDU not 48 bytes long
Invalid SAR segment type
CPCS CPI=0
AAL-5 CRC-32
Not an AAL-5 PDU

## ATM Layer

Data at this layer is captured in a cell-based buffer. Capture of ATM cells occurs at full line speed up to 622 Mbps into a data buffer. Each cell is stamped with a 100 ns resolution time stamp and, at rates up to 155Mb/s, the display is user customizable - absolute, relative to a specific event, or 'delta,' representing the time change from one cell to the next, and a field indicating whether the HEC was errored.

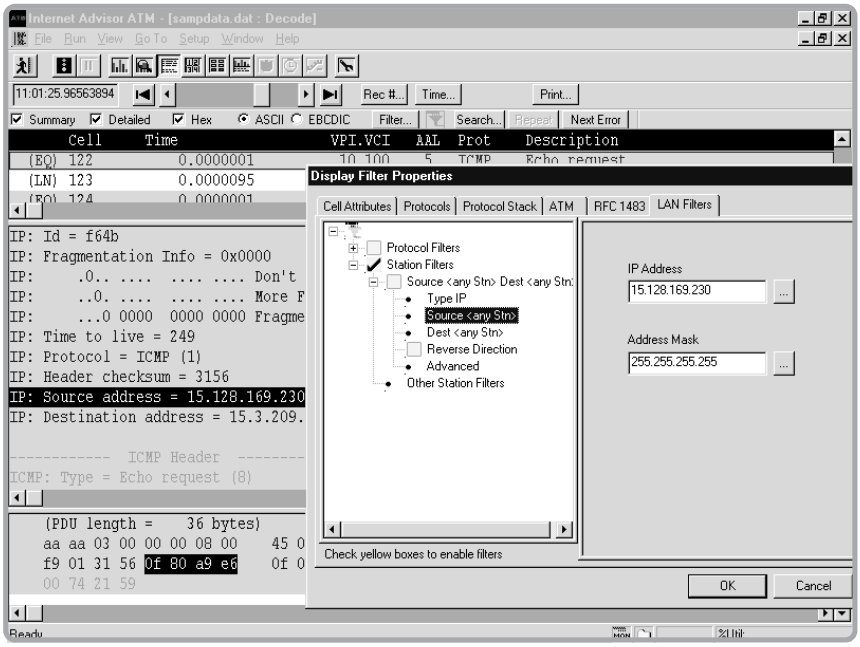
Display filtering of cells can be based on any of the header fields and also on many common types of embedded protocols. OAM cells can be monitored exclusively or with other data traffic for detailed analysis. Selective capture can be done using pre-written quick test scripts or user-defined capture filters.



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**Capture Filters and Counters**
Hardware counters and filters allow you to select cells or AAL5 PDUs to bring into the capture buffer. Even on a lightly loaded network, at ATM speeds it does not take long to fill a data capture buffer. With data filtering, you can zero in on exactly the data you need to see. The filters examine every cell in real time as it appears on the network. Because the filtering is done in hardware, nothing is missed, and performance of the measurements and user interface are not compromised.

Up to twelve hardware filters and counters can be enabled simultaneously and, additionally, any two of these filters can be enabled to capture all the cells that contain AAL5 PDUs. Flexible and user assisted menus allow you to define specific filters, counters, and triggers based on protocol headers. Examples include ATM, LAN over ATM (to RFC 1483), Frame Relay (FRF.5), LAN over Frame Relay over ATM (to RFC 2427 / 1490 and FRF.5 simultaneously), and Classical IP and ARP over ATM (RFC 1577). Filter and counter criteria can be used to start or stop the data capture and to center the data in the buffer, so that you can see what led up to an event and what followed it. Filter criteria may also be used to ignore or store the data.




Filters are also used as counters to specify statistical measurements based upon any part of the ATM header or payload on the line (network) side, the equipment (user) side of the link, or both. The counter and filter results provide the following:
Number of cells that met the filter criteria
Percentage of these cells out of the total busy (assigned) cells on the line
Percentage of bandwidth these cells occupied
Throughput in kbps of these cells
Throughput in cells per second of these cells

Whatever filters or connectors you select or create, the results are automatically grouped in real time.



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The following filters are provided, but you can easily create your own variations. You can also save specific interface configurations and traffic generation cell tables with your filter configurations:

IP address filtering
ILMI filtering
OAM filtering
Protocol distribution filtering
VP.VC filtering

**Display Filters and Searching**

Display filtering and searching lets you search through collected data to find specific IP addresses, values for protocol fields, or conversations on specific bi-directional virtual connections (by VPI-VCI). The display filters provide the flexibility to select protocol attributes or specific protocols from a checklist, and the power to filter on any bit, byte or characteristic, such as protocol. For example, you can filter on OAM traffic without having to know any of the protocol specifics.

Post-processing lets you quickly zoom in on selected criteria, from the traffic passing between specific devices to individual conversations. With post-processing, you can do the following:

Search through the data by record or by time stamp
Search for events or strings
Filter on protocols
Verify event-to-event timing
View protocol errors
Print a range of cells or the entire buffer
Export data in CSV (comma separated variables) format
Analyze statistics based on the buffered data

### ATM Cell Generation

An ATM cell editor allows you to build a *cell table* of up to 255 user defined or previously captured cells that can then be transmitted onto the network. Editing functions include the following:

Add
Edit
Delete
Copy
Insert

Windows keyboard commands are also supported – Ctrl-c, Ctrl-v, Ctrl-x, etc.

Sequences of captured cells (e.g. an AAL-5 PDU) can be copied and pasted to the cell table; the resulting cell table contents can be edited/modified (e.g. to change the VPI-VCI or to change embedded IP addresses) and the HEC and AAL-5 CRC recalculated, as appropriate, prior to transmission.

During the time that the cell table is not being sent, the Internet Advisor will send idle or unassigned cells. *Send Control* allows the contents of cell table to be sent once or repetitively, or for AIS or idle cells to be sent. The peak cell rate (PCR) of the cell table based traffic can be set from zero to the following maximum values, all of which are 100% utilization for that interface. Also, for ease of entry, a percent of utilization can be entered, such as 50% in place of the cells per second value.



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353,207 cells per second for STM-1/OC-3c, STM-1e and 155 UTP-5
104,268 for DS3 HEC
96,000 cells per second for DS3 PLCP
80,000 for E3 HEC
72,000 for E3 PLCP
59,111 for ATM25 with X8 8kHz timing reference
59,259 for ATM25 without X8 8kHz timing reference
3,623 cells for DS1
4,528 cells for E1

To generate OAM cells, you can use *quick tests* that include F4 and F5 segment or end-to-end cells with user-defined VPI[-VCI] values, which are transmitted from the traffic generator. To generate cell errors, you can modify the *quick tests* to add corrupted cells to the cell table.

The fields of the generated ATM cell header can be specified as follows:
VPI values from 0 to 255 (UNI), or 0 to 4095 (NNI)
VCI values from 0 to 65,535
GFC values from 0 to 15 (UNI only, not applicable in NNI)
PTI values from 0 to 7
CLP values of 0 or 1
HEC can be set to good (automatically calculated), bad, or user defined.

The generated ATM cell payload can be defined in hex, decimal, ASCII, or "don't care". Errors can be inserted on any bit within any byte of the payload.

## ATM Quality of Service (QoS) and Policing Tests

The Internet Advisor has the ability to do various real-time tests and measurements to check the performance of ATM networks. These fall into two main categories – policing and traffic contract shaped test cell generation, really mirror images of each other. In the case of policing, the Internet Advisor monitors live traffic and measures conformance to the traffic contract. Test cell generation allows test traffic shaped to a traffic contract to measure the network's ability to deliver the promised QoS, i.e. is the network meeting its SLA (service level agreement) obligations?

**Policing, traffic shaping and traffic contract measurements**
One of the most important premises of the deployment of ATM networks is the ability to maintain a given level of QoS within the public ATM network. ATM networks protect themselves by policing incoming traffic to check its conformance with pre-determined traffic contract parameters. Some cells may have to be discarded or "tagged" (marked to low priority) in order to protect the traffic of other users of the ATM network.

When customer traffic exceeds or 'violates' its contracted *peak cell rate* (PCR), taking into account its *cell delay variation tolerance* (CDVT), cells are discarded; when it exceeds the *sustainable cell rate* (SCR) parameters, taking into account its *maximum burst size* (MBS) allowances, cells may be discarded or tagged (cell loss priority (CLP) bit changed to 1), depending on the type of traffic contract. Low priority cells (CLP = 1) are discarded by core ATM switches before cells of normal priority (CPL = 0) when congestion occurs in the core network. Policing enables networks to assure a consistent quality of service within the core network so that individual users don't degrade the performance of the network for other users.



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The Internet Advisor's policing measurement feature is a real time measurement that checks a virtual connection's conformance to the traffic contract at the ingress to the public network; this could be a virtual channel connection or virtual path connection. The user specifies the traffic contract type (e.g. VBR.3/SBR3) and parameters (PCR, CDVT, SCR and MBS) for the virtual connection and the Internet Advisor counts the non-conforming test cells and delivers a non-conformance count and non-conformance ratio for live user traffic. This measurement would be used typically to check a user's traffic either side of the boundary to the public network when quality of service is suspect (the user experiences unexpected levels of cell loss). If the user traffic entering the network does not conform, the network cannot be blamed for the resulting poor QoS.

**Traffic Contracts Supported**

The user may specify one of the following types of traffic contract to determine how many cells in the virtual connection are conforming or non-conforming:

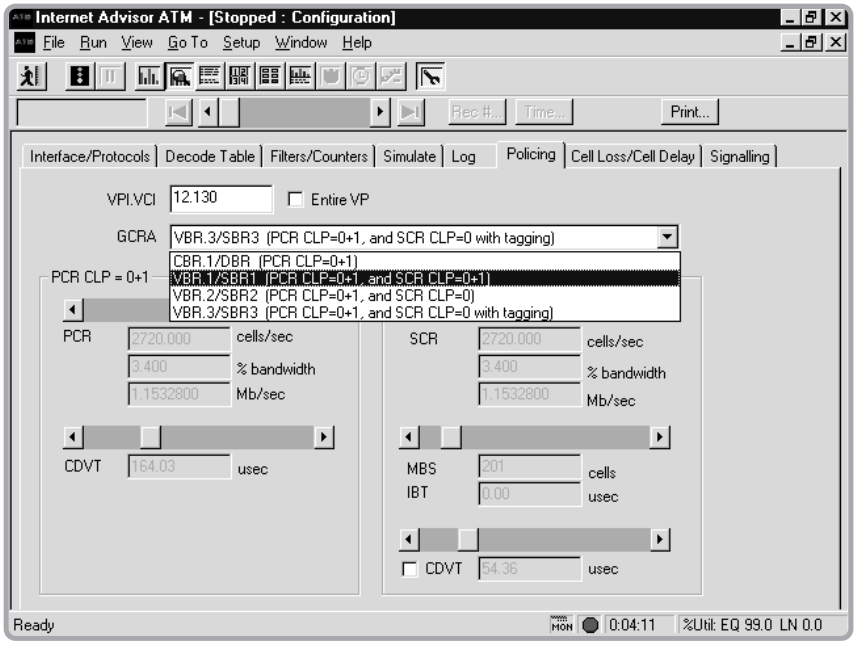
CBR.1/DBR/UBR.1: GCRA(1/$PCR_{0+1}$, $CDVT_{0+1}$)

VBR.1/SBR1: GCRA(1/$PCR_{0+1}$, $CDVT_{0+1}$), GCRA(1/$SCR_{0+1}$, $BT_{0+1}$), no tagging

VBR.2/SBR2: GCRA(1/$PCR_{0+1}$, $CDVT_{0+1}$), GCRA(1/$SCR_{0}$, $BT_{0}$), no tagging

VBR.3/SBR3: GCRA(1/$PCR_{0+1}$, $CDVT_{0+1}$), GCRA(1/$SCR_{0+1}$, $BT_{0+1}$), tagging supported

(note that in this notation, subscripts "0" and "1" means high and low priority cells respectively, so "0+1" means all cells; note also that BT (burst tolerance) is derived from the MBS, PCR and SCR values)




**Shaping of test cell traffic and background traffic**

There are two sides to any contract and ATM traffic contracts are no exception. If the user traffic keeps to its contract obligations then the network should deliver the quality of service it guarantees in the traffic contract. This is usually specified in terms of cell loss and added cell delay variation, etc.



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The Internet Advisor is able to measure ATM layer QoS by generating test traffic shaped to meet the traffic contract in terms of PCR, CDVT, SCR and MBS; it also allows users to choose the standardized "Generic List" values for the parameters. The test traffic comprises test cells which conform to ITU-T Recommendation O.191 which specifies the test cell and the methodology for measuring ATM layer QoS parameters specified in ITU-T Recommendations I.356 and I.357, and the ATM Forum's Traffic Management Specification version 4.1. Measurements made by the Internet Advisor are as follows:

| | |
|---|---|
| Cell Loss Ratio | Maximum Cell Transfer Delay |
| Cell Misinsertion Rate | Severely Errored Cell Block Ratio |
| Cell Error Ratio | Availability Ratio |
| Cell Delay Variation | Transmitted Cells |
| Mean Cell Transfer Delay | Non-Conforming Cells |
| Minimum Cell Transfer Delay | Tagged Cells |

Test traffic can be sent and received by the same Internet Advisor for local testing or it can be sent by one Internet Advisor and received on the other side of the network by another. Each can source test traffic in the opposite direction on the same bi-directional virtual connection and, at the same time, analyze traffic from the other; each Advisor is configured to source traffic which conforms to the traffic contract for that direction of the virtual connection; such connections are often asymmetrical. As conforming test traffic is entering the network, any cell loss or cell delay variation detected on the far side of the network must be caused by the network itself; this can be compared with the SLA requirement to check that the network is complying with its side of the agreement. The Internet Advisor is also capable of generating same link background traffic (on other virtual connections). For more details about policing and shaping, see the ATM QoS White Paper.

**Test Cells**

The ITU-T Recommendation O.191 specifies a test cell and a methodology for using it to determine ATM QoS measurements, as defined in ITU-T Recommendation I.356 and I.357. The ATM Forum references I.356 in its Traffic Management 4.1 specification.

The O.191 test cell has a standard header for any user channel (any VCI above 31 is allowed). The payload has a number of special fields which allow the QoS measurements to be made: there is a 32 bit "sequence number" field for measurements of cell loss (ratio) and cell misinsertion (rate); there is a 32 bit time stamp (with 10ns granularity in the least significant bit) for cell delay and cell delay variation measurements, and the entire payload is error checked by a CRC-16 for measurements of cell error. In addition, the entire payload is scrambled to ensure that all bits of the payload are exercised so that memory-based switch fabrics can be tested for "stuck" bits.

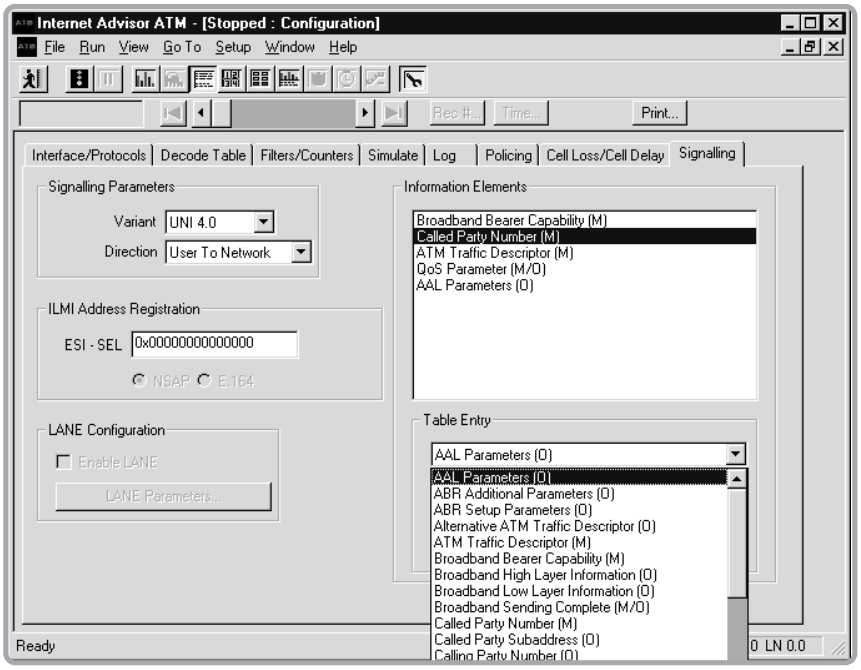
Because the O.191 test cell and the methodology for its use are standardized, O.191 conformant test equipment from different vendors can inter-operate. Results should be consistent between equipment from different vendors. Proprietary extensions are permitted, however, and Internet Advisors working together (one at each end of a virtual circuit) can detect when the network has tagged (market to low priority, i.e. CLP = 1) a cell which was sent at normal priority (CLP = 0); these events are counted.

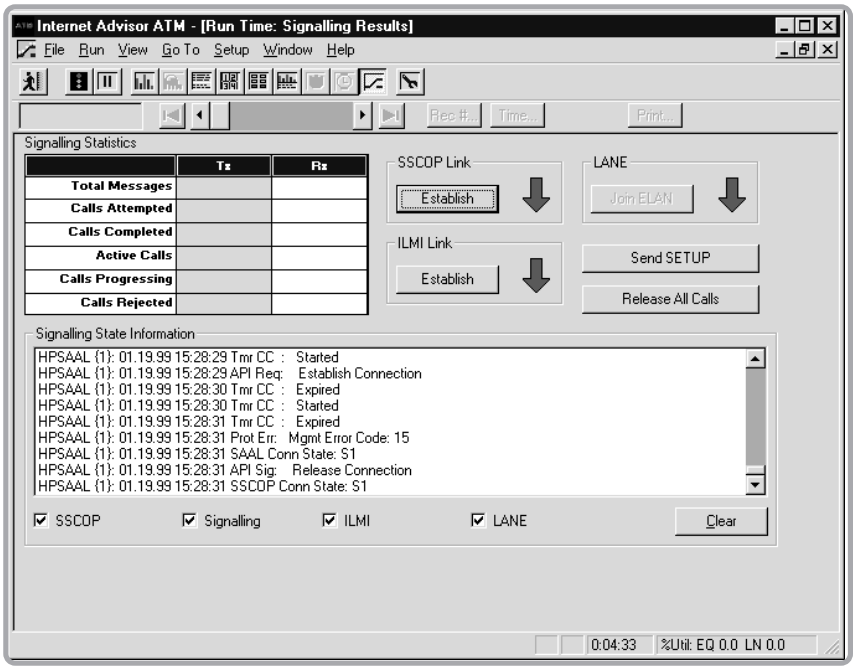


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## ATM Signaling and Call Placement

While permanent virtual circuits (PVCs) have dominated the ATM world thus far, switched virtual circuits (SVCs) play an increasing part. Because of this, it is necessary to be able to have confidence that SVCs can be set up, and to be able to troubleshoot when things go wrong.
The Internet Advisor includes UNI signaling emulation, ILMI address registration and LANE emulation to provide connectivity testing. The signaling and call placement feature supports ATM Forum UNI 3.0, 3.1 and 4.0. The Internet Advisor can emulate the user or network side of the UNI. In addition, the user can specify and edit the information elements (IEs) placed on Call Connect messages that specify what type of SVC to bring up.






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## Physical Layer

### Bit Error Rate Testing (BERT)

Many times problems on the network can be attributed to the transmission medium. The Internet Advisor has a powerful, built-in bit error rate test capability that performs not only frame-based BERT (SDH/SONET-level), but also cell-based BERT, in which the bit patterns are carried in the payload of the ATM cell.

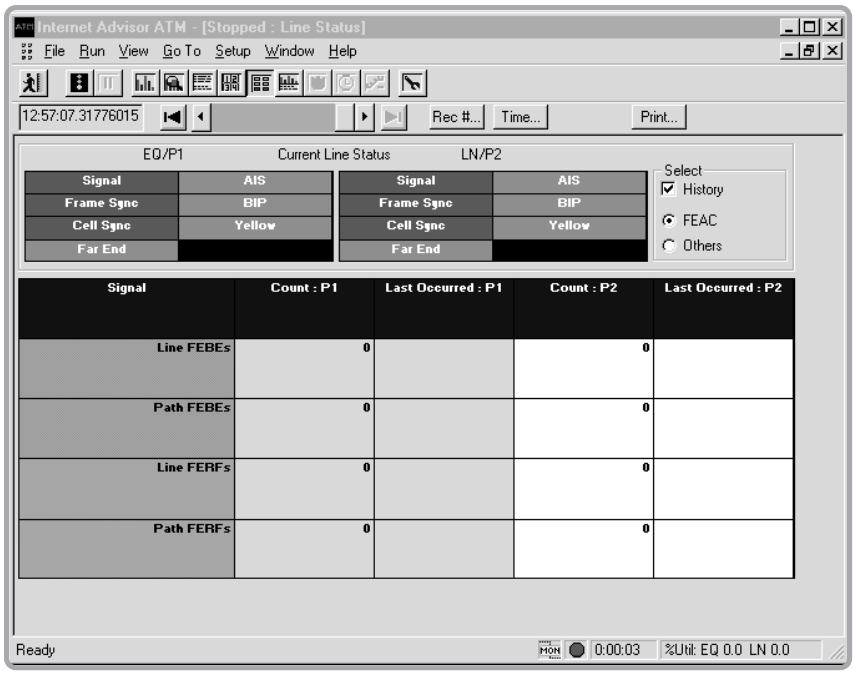
Testing Patterns: 1111, 1010, 1100
PRBS: $2^{15}$-1, $2^{20}$-1, $2^{23}$-1
User defined - one octet (8 bits)

### Optical Power Measurements

In addition to full ATM analysis, The Internet Advisor STM-1/OC-3c ATM interface has a built-in optical power meter that allows you to check power levels with an accuracy of +/- 0.5 dBm. This measurement capability may also be performed using the same interface on an optical fiber carrying STM-4c/OC-12c, even though the interface does not otherwise operate at 622Mb/s.

### Line Status

The operation of the physical interface is often critical in determining the cause of network problems. Therefore, the Internet Advisor tracks errors at the physical layer, and stamps the information with a 1 ms time stamp. Counts of error and alarm events are recorded on the display for both the line (network) and equipment (user) side. The time of the last occurrence of a particular event is recorded as well. Events are saved in the buffer and can be logged to disk.




Line status is displayed in real time. All of the events listed below are saved in the buffer and counted in the line status display. These events may be logged to disk. The current status of critical parameters (marked with an asterisk (*)) is also displayed in large green or red boxes in the line status display, for easy, at-a-glance viewing.



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**T1/DS1**

Loss of signal (LOS) (*)
Loss of frame (LOF) (*)
Loss of PLCP sync (LOPS) (*)
AIS (*)
RAI/Yellow (X-bits) (*)
Bi-polar violations
ESF CRC errors
Line code violation (B8ZS)
Frame slips
Frame bits
One's density
Excess zero's
Loss of Cell Delineation (LCD) (*)

**E1**

Loss of Signal (LOS) (*)
Loss of Frame (LOF) (*)
Line code violations (HDB3)
RAI (FERF) (*)
AIS (*)
CRC-4 errors (if CRC-4 is selected)
Frame alignment error
Loss of Cell Delineation (LCD) (*)

**ATM25**

Loss of Signal (*)
Loss of Synchronization (*)
Timing sync frequency
Invalid Symbol
Short Cell

**E3**

Loss of signal (LOS) (*)
Loss of frame (LOF) (*)
BIP-8
Line code violations (HDB3)
Payload type mismatch
REI (FEBE)
RDI (FERF)
AIS (*)
Loss of Cell Delineation (LCD) (*)

**T3/DS3**

Loss of Signal (LOS) (*)
Loss of Frame (LOF) (*)
Remote/Yellow (X-bits) (*)
AIS (*)
Line code violations (B8ZS)
FEBE
Idle (*)
P1/P2 parity errors
C-bit parity errors
PLCP sync loss (*)
PLCP Yellow (*)
PLCP BIP
PLCP FEBE
FEAC (*)
FEAC DS3 line
FEAC loss of signal/HBER
FEAC loss of frame
FEAC AIS
FEAC idle
FEAC service failure
FEAC no service failure
FEAC common equipment failure
FEAC line loopback activate
FEAC line loopback de-activate

**STM-1/STM-1e/OC-3c**

Loss of Signal (LOS) (*)
Loss of Frame (LOF) (*)
Loss of Pointer (LOP)
B1, B2, B3 BIP errors
Summary BIP error (*)
Label mismatch
MS-REI/ REI-L (Line FEBE)
REI/ REI-P (Path FEBE)
MS-RDI / RDI-L (Line FERF) (*)
MS-AIS / AIS-L (*)
RDI / RDI-P (Yellow)
AIS / AIS-P
Summary Far End (RDI or REI) (*)
Loss of Cell Delineation (LCD) (*)
Remote
Optical power (except STM-1e)
Pulse Amplitude (STM-1e only)



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**UTP155**

Loss of signal (LOS)(*)
Loss of frame (LOF)(*)
Loss of pointer (LOP)
B1, B2, B3 BIP errors
Summary BIP error (*)
Label mismatch
REI-L (Line FEBE)
REI-P (Path FEBE)
RDI-L (Line FERF) (*)
AIS-L (*)
RDI-P (Yellow)
AIS-P
Summary Far End (*)
Loss of Cell Delineation (LCD) (*)
Remote

**STM-4c/OC-12c**

Loss of Signal (LOS)
Loss of Frame (LOF)
Loss of Pointer (LOP)
Out of Frame (OOF)
MS-RDI / RDI-L (Line FERF)
MS-AIS / AIS-L
RDI/ RDI-P (Yellow)
AIS / AIS-P
MS-REI and counts / REI-L (Line FEBE)
REI and counts / REI-P (Path FEBE)
Label mismatch
Loss of Cell Delineation (LCD)
B1, B2, B3 BIP error counts
BIP error indication

**ATM Network Vitals**

Vitals provides real-time statistics of network conditions that provide a statistical picture of what is happening on the ATM links. Working simultaneously with decodes, filters, and other measurements, the Vitals feature interprets data traffic as it occurs. This feature can be used to identify network problems or to assist you in optimizing the configuration of network components and software.

Values in the Vitals display are presented in tabular form and are cumulative from the start of a test. An exception is instantaneous utilization, which is also displayed in graphical format for a quick look at overall usage of the network. Vitals data are provided for both the network and the subscriber sides of the connection.

**T1/DS1**

Average utilization in %
Instantaneous utilization in %
Total cells received
Idle cells received
Busy cells received
HEC errors received
Bi-polar violations
ESF CRC errors
Frame slips
Frame bits
One's density
Excess zero's

**E1**

Average utilization in %
Instantaneous utilization in %
Total cells received
Idle cells received
Busy cells received
HEC errors
Code violations
CRC-4 errors
Frame alignment errors

**ATM25**

Average utilization in %
Instantaneous utilization in %
Total cells received
Idle/unassigned cells received
Busy (assigned) cells received
Header ("HEC") errors



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**E3**

Average utilization in %
Instantaneous utilization in %
Total cells received
Idle/unassigned cells received
Busy (assigned) cells received
Header ("HEC") errors received

Code violations
REI (FEBE)
RDI (FERF)
BIP-8
Label mismatches

**T3/DS3**

Average utilization in %
Instantaneous utilization in %
Total cells received
Idle cells received
Busy cells received
HEC errors received

Code violations
DS3 FEBE
P1 / P2 parity
0C-bit parity
PLCP BIP8
PLCP FEBE

**STM-1/STM-1e/OC-3c**

Average utilization in %
Instantaneous utilization in %
Total cells received
Idle/unassigned cells received
Busy (assigned) cells received
Header ("HEC") errors received

Code violations
MS-REI/ REI-L (Line FEBE)
REI / REI-P (Path FEBE)
MS-AIS / AIS-L
AIS / AIS-P
Loss of Cell Delineation (LCD)

**UTP155**

Average utilization in percent
Instantaneous utilization in %
Total cells
Idle/unassigned cells
Busy (assigned) cells
Header ("HEC") errors

Code violations
REI-L (Line FEBE)
REI-P (Path FEBE)
AIS-L
AIS-P
Loss of Cell Delineation (LCD)

**STM-4c/OC-12c**

Auto-discovery of up to 4,095 VCs
Instantaneous utilization in % per VC
Peak % of total bandwidth per VC
Total cells received per VC
Header ("HEC") errors received

## WAN Testing

All major WAN interfaces, including V.10/V.11, V.24/V.28/RS-232C, V.35 and V.36/RS-449/422/423 are already built into the instrument mainframe; X.21 (with J2277A external cable – V.36/RS-449 to DB15) and RS-530 (with external cable J2278A – V.36/RS-449 to DB25) are also available. Other interfaces, including ISDN basic rate interfaces (BRI) S/T/U and primary rate interfaces (PRI), ATM STM-1/OC-3c, E3/DS3 Cell and Frame, ATM 155 UTP, E1/T1, HSSI, DDS 4-wire, are available as slide-in modules or as undercradle for 10/100 Ethernet, Gigabit, Token Ring and FDDI, STM-4c/ OC-12c ATM.

Monitoring of LAN data over WAN and ATM is a standard feature. Real-time monitoring of network conditions is an Internet Advisor powerful testing capability to dig deeply into the data if needed.

Because the Internet Advisor is a multitasking instrument, you can execute any of the active stimulus/response tests while the analyzer simultaneously monitors their effect on the network.



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The Internet Advisor traffic generation is another powerful tool; it allows the transmission of virtually any type of message or frame onto the network. To get statistical information about the data on your network, the Internet Advisor will analyze every frame and count user definable events. A number of counters have been pre-defined for Frame Relay, X.25, HDLC, SNA-SDLC, synchronous and asynchronous PPP, ISDN and SMDS.

The Internet Advisor equipped with the standard bit error rate testing (BERT) and is capable of generating BERT patterns onto T1, E1, E3, or DS3 WAN links.

No matter if your testing needs are for Frame Relay at E3/DS3 or HSSI speeds or for low speed links, such as Async and Bisync, the Internet Advisor provides all of these functionality under one single handle solution.

### Unmatched WAN Solutions

WAN testing solutions are provided from the easy-to-use main Windows® user interface:

Network Line Vitals
Frame Relay DLCI Statistics
X.25 LCN Statistics
Top Talker Statistics
Decode View
Filters/Counters Statistics
Full bandwidth traffic generation
Line Status
Simulation
Configuration
ISDN B-channel call tracking Expert

**WAN Analysis Capabilities**
The Internet Advisor provides real-time and post-processing Layer 2 and Layer 3 analysis capabilities for:

Frame Relay
ISDN
X.25
HDLC
PPP (Sync, Async)
SMDS (optional)
SNA
ATM DXI
V5.1/V5.2
Async and Bisync

## Frame Relay

No matter how complex your testing needs are, the Internet Advisor with interfaces such as the T1, E1, E3/DS3, or the HSSI allows network managers to test and troubleshoot complex WAN environments to solve WAN access and inter-networking problems quickly.

The Internet Advisor provides extensive real-time and post-processing test capabilities for the Frame Relay protocol according to the following recommendations:

ITU-T Q.933 Annex A
ANSI T1.617 Annex D
Original Frame Relay consortium



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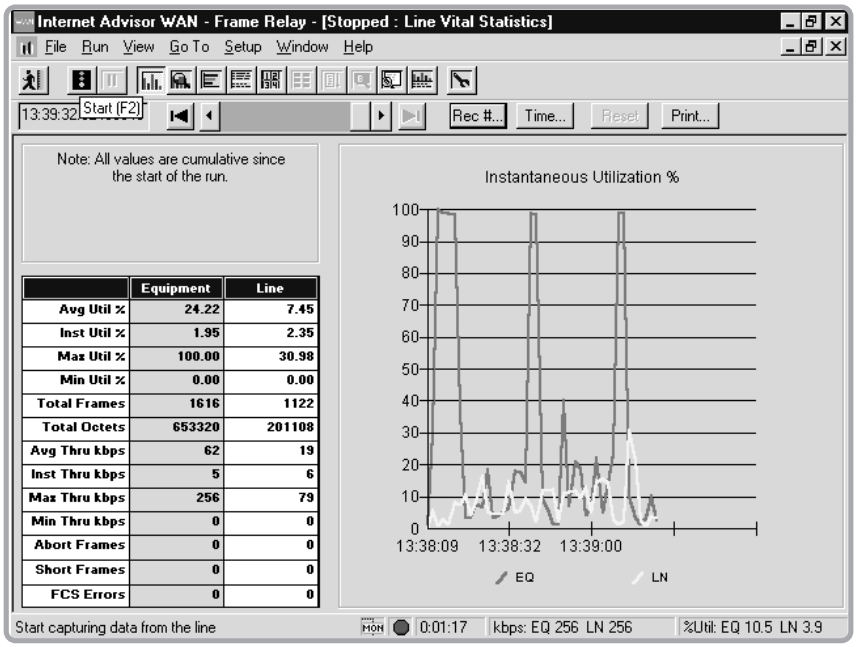
The Internet Advisor with its extensive Frame Relay testing capabilities allows you to:

Verify the Physical Interface and Layer
Verify the Link Layer
Verify the In-Channel Signaling
Verify the PVC Assignments
Verify Data Transfer

These basic verification techniques are general approaches to WAN analysis and troubleshooting that are accepted in the industry because of their systematic appeal and proven effectiveness.

## Frame Relay Network Vitals

Network Vitals provide real-time measures of network conditions to present a statistical picture of what is happening on the network links. Working simultaneously with decodes, filters, and other measurements the Vitals feature interprets data traffic as it occurs. This feature can be used to identify network problems or to assist you in optimizing the configuration on network components and software. Vitals are gathered in intervals of 1 second. Values may also be logged to disk.




| | Equipment | Line |
|---|---|---|
| Avg Util % | 24.22 | 7.45 |
| Inst Util % | 1.95 | 2.35 |
| Max Util % | 100.00 | 30.98 |
| Min Util % | 0.00 | 0.00 |
| Total Frames | 1616 | 1122 |
| Total Octets | 653320 | 201108 |
| Avg Thru kbps | 62 | 19 |
| Inst Thru kbps | 5 | 6 |
| Max Thru kbps | 256 | 79 |
| Min Thru kbps | 0 | 0 |
| Abort Frames | 0 | 0 |
| Short Frames | 0 | 0 |
| FCS Errors | 0 | 0 |

Values in the Vitals display are presented in tabular form and are cumulative from the start of a test. Instantaneous utilization is displayed in graphical format for a quick look at overall usage of the network. The following values are provided for both the Line (Network) side and the Equipment (User) side:

Max., min., and avg. utilization (%)
Max., min., inst., and avg. throughput in kbps
Total octets (bytes)
Total frames/packets
Short frames/packets
Abort frames/packets
FCS errors

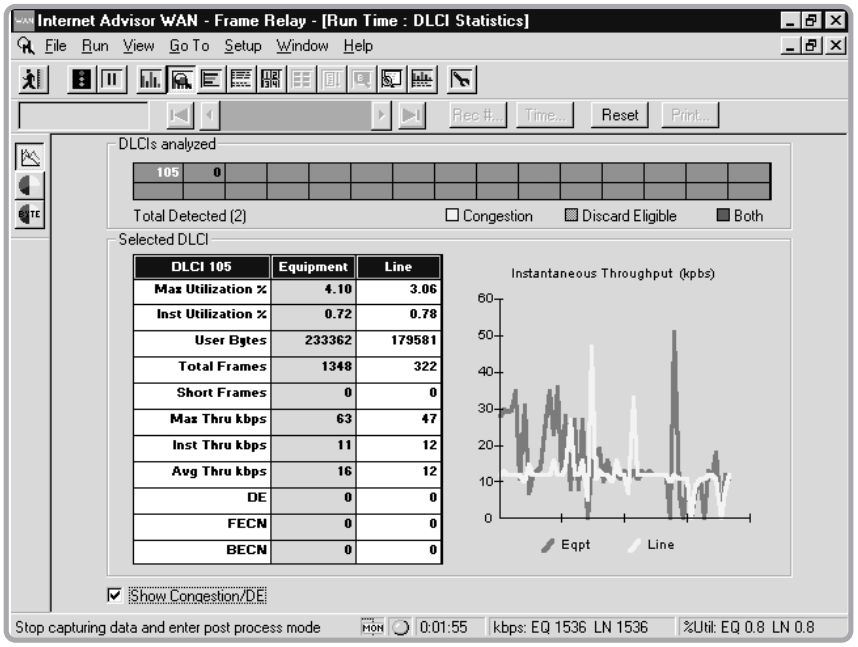


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## DLCI Statistics

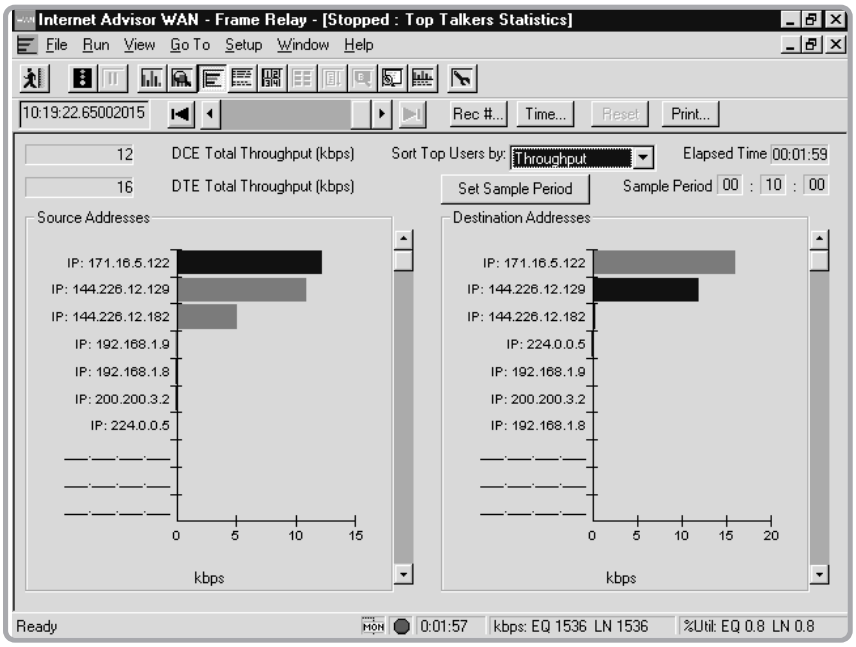
Displays first 32 observed DLCIs (all data stored to capture buffer).
Displays both the CPE and the Network statistics:
Throughput in kbps
Frame Distribution
Byte Distribution

The following values are provided for both the Line (Network) side and the Equipment (User) side.
Max., and inst., utilization (%)
Max., inst., and avg. throughput in kbps
Total octets (bytes)
Total frames/packets
Short frames/packets
DE
FECN
BECN






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## Top Talkers

Determines which IP and IPX users consume the most Frame Relay bandwidth.
256 Top Talkers identified
Sorts the IP and IPX source and destination statistics
Traffic identified as DTE or DCE
Throughput in kbps
Frame rate and percentage (%) utilization
Samples from 2 seconds to 24 hours
Specified periods by hours, minutes and seconds
Updates measurement interval every 2 seconds

## Decodes

The Internet Advisor provides the ability to decode correlated Frame Relay network traffic with its enhanced decode view:

**Summary**
- Absolute, Delta and Relative Time based on marked frame

**Detailed**
- Color coded protocols

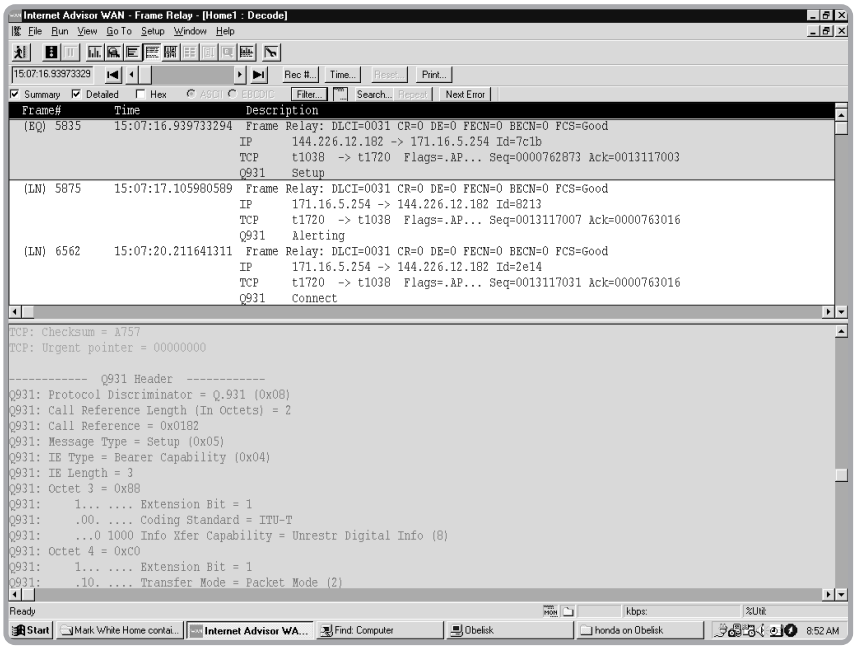
**Hex**
- Hex to detailed mapping

The analyzer decodes and displays the following fields:
DLCI, DE, FECN, BECN, E/A and FCS
Auto LMI detection and decoding for ANSI T1.617 Annex D, ITU-T Q.933 Annex A, original LMI
Auto CLLM detection and decoding
Auto multi-protocol encapsulation detection and decoding according to RFC 2427/ RFC 1490/ Ethertype, FRF 3.1
ANSI T1.617a Annex G (X.25 over Frame Relay)



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Double clicking on a field in the Detailed Pane of the decode Window will cause the appropriate fields in the Hex decode pane to be inverse highlighted giving the user greater analysis capabilities in the decode view.
- Configurable display to customize decode output.




## WAN Capturing, Filtering and Searching

The Internet Advisor will capture every frame, no matter what the traffic level, and that is exactly what you need. But sometimes it can take a long time to search through hundreds of captured frames looking for a problem. Also, even on a lightly loaded network, at high speeds such as E3/DS3 or HSSI it does not take long to fill the data capture buffer.

Data Filters allow you to select specific events to bring into the capture buffer. With data filtering, you can zero in on exactly the frames you need to see. The filters examine each and every frame in real time as it appears on the network, and because the filtering is done in hardware, nothing is missed.

Up to 16 hardware data filters can be enabled simultaneously or individually turned on or off. A flexible and user-friendly menu allows you to define specific filters, counters, and triggers:
Up to 16 hardware data filters
Enabled simultaneously or individually
Flexible, user friendly menu for protocol specific filter and counter setup
Several user selectable actions for triggers
Filter up to 64 bytes into the frame

Filter/Counter Statistics are available in Graphical and statistical view of the network based on setup filters/counters:
Graph type
- Bar
- Pie

Mode
- Instantaneous
- Cumulative

Graph
- % of frames
- Throughput (frame/s)



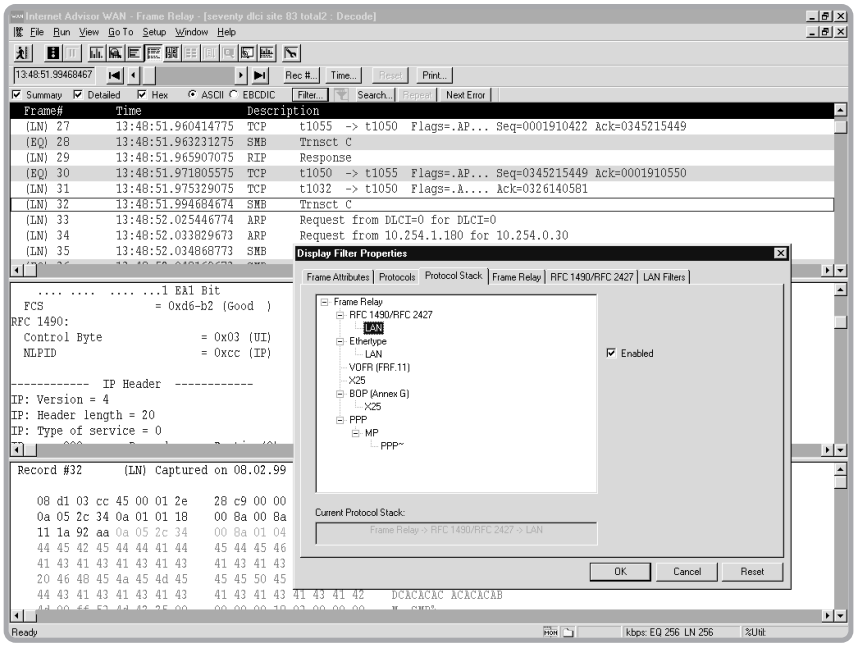
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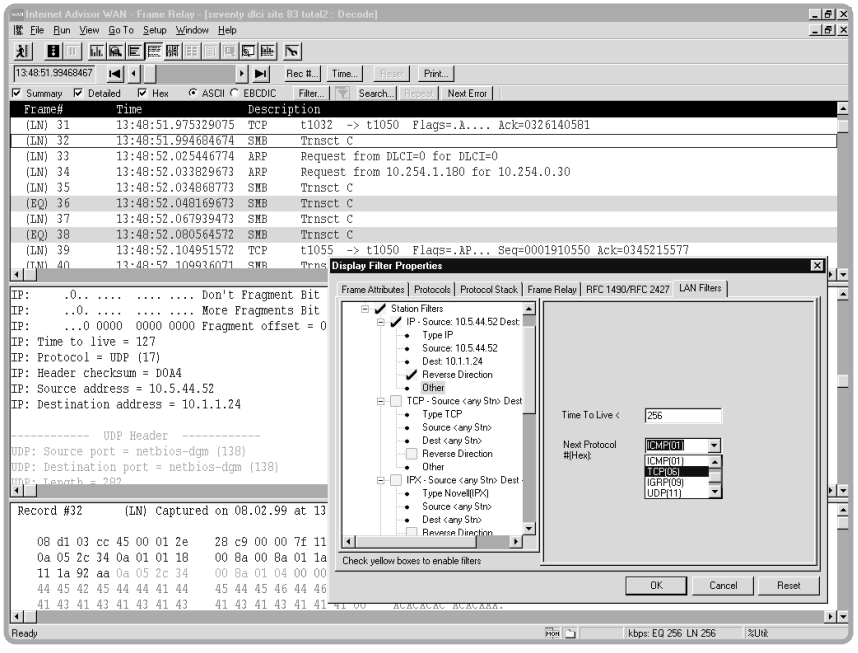
Display filters let you zoom in on selected criteria, from the traffic passing between specific devices to individual conversations. With post-processing, you can do the following:

Flexible, user friendly menu for protocol specific filter setup
Search through the data by record or by time stamp
Search for events or strings
Verify event-to-event timing
Search for view protocol errors
Print the current display or the entire buffer
Export data to other programs
Analyze statistics from the buffer data

## User Assisted LAN over Frame Relay Filtering

The **User Assisted LAN over Frame Relay** allows the user to perform LAN filtering and searching on LAN nodes, Layer 3 protocols, IP source and destination addresses.



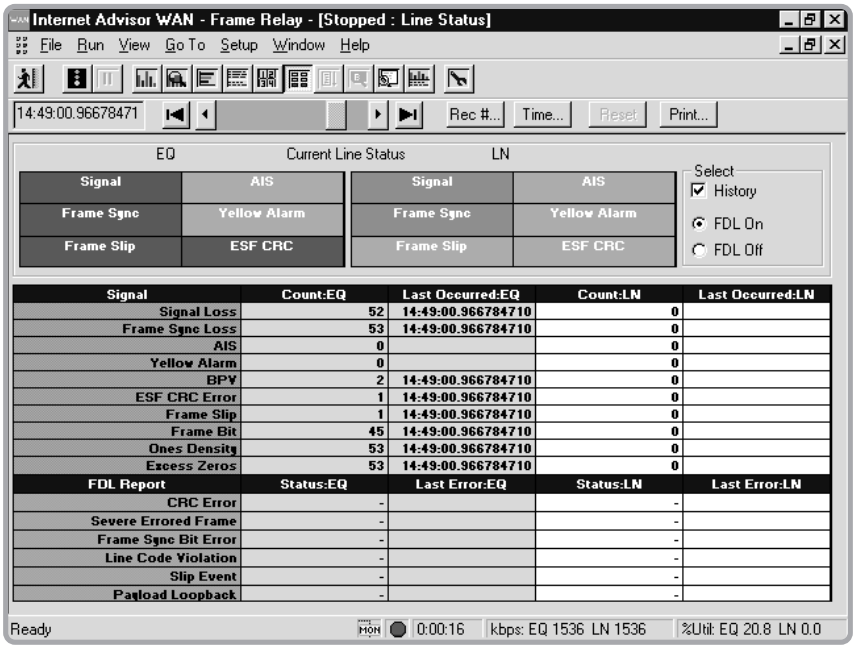






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## Line Status

The Line Status View displays run-time and historical state of the physical T1, E1, E3, DS3 and HSSI links.
Current Line Status
Line Status History




## Simulation and Traffic Generation

Because the Internet Advisor is a multitasking instrument, you can execute any of the active stimulus/response tests while the analyzer simultaneously monitors their effect on the network.

The Internet Advisor WAN provides a series of pre-written and pre-configured test routines; others can easily be written by the user. Test scripts can be customized and saved as a new tests to build a library of powerful test sequences tailored to your individual applications.

Frame Relay test scripts:
Auto User LMI
Frame Relay PING
Traffic generation

## Auto User LMI

The Auto User LMI test script auto-determines signaling type as:
ITU-T Q.933 Annex A
ANSI T1.617 Annex D
Original Frame Relay Consortium (Original LMI)

Selections are the polling count N.391 from 1-255 and the polling interval T.391 from 5-25 seconds.



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## Frame Relay Ping

Frame Relay PING automatically supports emulation for:
ITU-T Q.933 Annex A
ANSI T1.617 Annex D
Original Frame Relay Consortium (Original LMI)

PING without LMI can be selected

PING selections are:
Destination IP address
Source IP address
Layer 2 address or DLCI
Number of ICMP data bytes (range between 1 and 1400)
Number of requests
Continuous or select between 1 and 9999 requests and specify time-out (from 1ms to 32s)
Encapsulation Ether type and RFC 1490/RFC 2427
Simulate mode can be either DTE or DCE

## Traffic Generation

The Internet Advisor WAN has powerful and flexible traffic generator capability. Virtually any type of message or frame can be transmitted onto the network.
Transmit frame once, specified number of times, or continuously
Transmit previously captured frames
Emulation supported Frame Relay (Annex D, Original LMI, and Annex A)
Maximum traffic generation rate 100% of available bandwidth allowed by protocol specifications
Line speeds 50 bps to 52 Mbps
Traffic generation protocols supported HDLC/SDLC, Frame Relay and X.25
Frame lengths allowed 4 bytes (address, control and FCS) to 9216 bytes per frame
Specify traffic rates by:
- 1% to 100 % utilization
- interframe flags
- frames per second (30,000/sec)
- interframe delay (milliseconds)

Maximum measured line rate 99%
Maximum number of different frames allowed 20
Define up to 4 different blocks, each having different traffic levels and patterns
Use Quick Tests for commonly used message types
Interfaces supported V.24/V.28/RS-232C, V.35, V.36/RS-449/422/423/530, X.21, T1, E1, HSSI, and DS3
Clock source DTE/equipment, DCE/Line, internal, or recovered(50 bps to 52 Mbps)
Full bandwidth, channelized (DS1), fractional (DS0) on DS3 traffic generation



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## Configuration

Depending on the interface and application the configuration allows the user to select entries and options for:
Interface/Protocols
Decode table (protocol routing through decodes)
Filters/Counters
Log
Simulate
Full traffic generation

Auto-configuration for T1 and E1 interfaces are available.

**Auto-configure T1 (physical layer)**
Auto-determine
- Line Code (AMI or B8ZS)
- Framing (ESF, D4, T1DM or Unframed)
- Receiver mode (Monitor Bridged, Monitor terminated, or Monitor Jack)

**Auto-configure E1 (physical layer)**
Auto-determine
- Line Code (HDB3 or AMI)
- Framing with CRC-4, without CRC-4, or Unframed
- Receiver mode (Monitor Bridged, Monitor Terminated, or Monitor Jack)

**Auto LMI in Decode Routing (link layer)**
Auto LMI recognition will automatically detect the type of LMI on the Frame Relay link.
Decoding of the correct LMI version will take place automatically for the following standards:
ITU-T Q.933 Annex A
ANSI T1.617 Annex D
Original Frame Relay Consortium (Original LMI)
The Frame Relay application will decode the Consolidated Link Layer Management (CLLM) messages, found on DLCI 1007.

**Auto Multi-protocol over Frame Relay (network layer)**
The Frame Relay applications will decode the multi-protocol encapsulation over Frame Relay automatically according to the RFC-1490, RFC-2427, Ethertype or FRF.3.1, CLLM.



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## VoFR and FoFR Decodes and Filtering

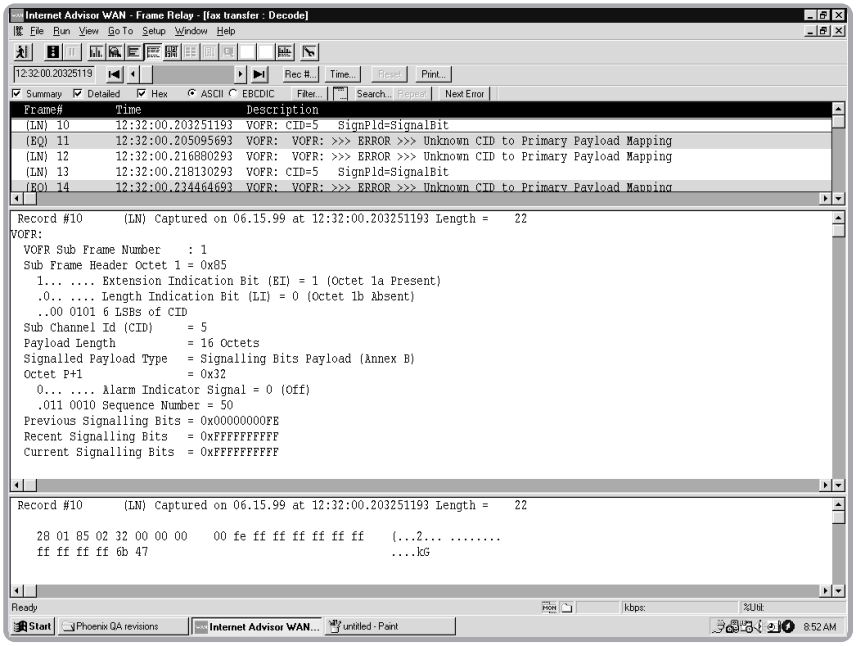
The Internet Advisor support Voice and Fax over Frame Relay decodes and filtering based on the Frame Relay Forum FRF.11 - Voice over Frame Relay Implementation Agreement.

The Internet Advisor Voice over Frame Relay solution provides decodes for the headers of the different transfer syntax, such as:
G.729 CS-ACELP
G.728 LD CELP
G.723.1 MP-MLQ
G.726/G.727 ADPCM
G.711 PCM

*Note: Voice compressed data is only shown in Hex format*

The VoFR decodes provide extensive information for the primary payload. Three basic types of primary payloads are utilized:
encoded voice payloads
encoded FAX payloads
data payloads

The VoFR decodes provide detail information for the Sub-frame Format Sub-channel Identification (CID) and the different Annexes of the VoFR FRF.11 Implementation Agreement.






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# ISDN

## A Fully Integrated Monitoring, Simulation, and BERT Solution

Isolate basic and primary rate ISDN problems with the multitasking Microsoft Windows-based ISDN software solutions from the Internet Advisor.

The Internet Advisor is a multi-protocol, multi-interface protocol and performance analyzer that connects to any ISDN interface: basic rate S/T and U, as well as primary rate.

Complete, real-time ISDN decodes with summary and detailed displays and extensive D-channel statistics let you quickly isolate network problems.

The Internet Advisor supports 18 different ISDN switch and country variants; extensive decodes on the user data channel allow LAN interconnect problems to be solved quickly.

## Key Features

Solve problems quickly using Internet Advisor's many pre-written tests and its intuitive user-interface
Verify the integrity of the link to carry data with complete bit error rate testing (BERT) on a B-channel while simulating on the D-channel
Check network connectivity with pre-written simulation tests
Monitoring
- Decode D and B channels
- Full data capture for the S/T, U and T1 or E1 interfaces
- B-channel voice and data call tracking Expert
- Improved post-process filtering for the ITU-T Q.931 decodes
- Easy D- or B-channel monitoring for ISDN troubleshooting

Simulation
- Call Placement
- Full data simulation capability for the S/T, the U, and T1 or E1 interfaces

ISDN Bit Error Rate Testing
- Run BERT on a B-channel while simulating on the D-channel

Loopback BERT bits or patterns
Statistical analysis of B and D channel activity
All interfaces supported
- Basic Rate (S/T and U)
- Primary Rate (T1 and E1)

## ISDN Test Capabilities

Complete decode of ISDN D- and B-channel real-time; Line Vitals, Channel Statistics, Filter/Counter Statistics, Line Status, Summary and Detailed displays available.
Complete level 1 information state analysis, Q.921 (LAP-D) and Q.931 information elements.
All major Q.931 variants, including ETSI, NI-1 and 18 other signaling decodes from the major switch manufactures and countries.
Full X.25 decode on the D-channel
Monitor and decode LAN traffic encapsulated in ISDN
Decode Frame Relay, PPP, X.25 and HDLC on the B-channel
Supports B1+B2 (128 kbps) monitoring
Verify connectivity and provisioning with pre-written call placement scripts
Check the integrity of the link to carry traffic with complete BERT testing on a B-channel while simulating on the D-channel
Q.931 message type statistics; log statistics to disk to catch intermittent problems



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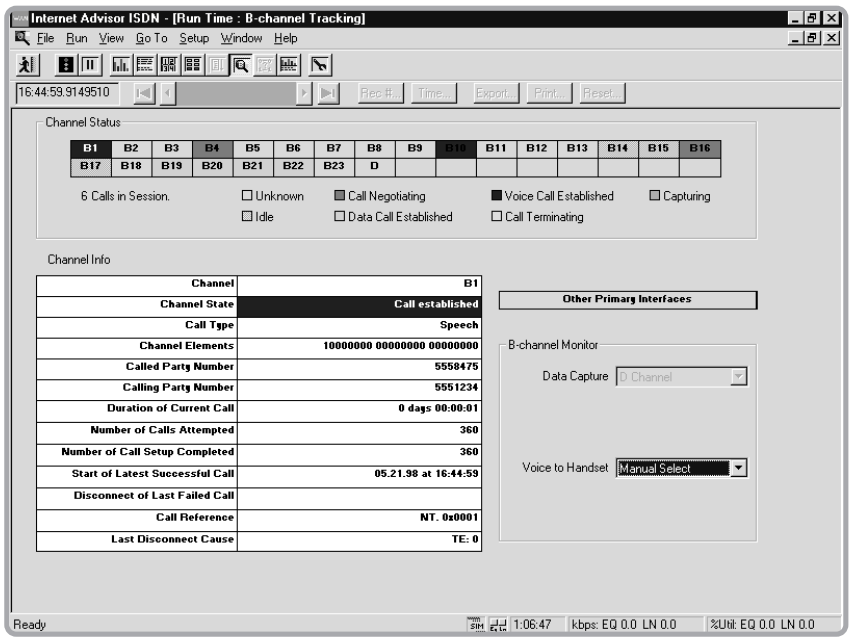
Extensive B-channel traffic statistics: Channel State, Call type, Channel Elements, Called Party Number, Calling Party number, Duration of Current Call, Number of Calls Attempted, Number of Call Setup Completed, Start of Latest Successful Call, Disconnect of Last Failed Call, Call Reference, Last Disconnect Cause

Test on BRI passive bus networks; one product to access any point in the network

B-channel Expert activity monitor tracks voice and data usage on all B-channels

Multi-link PPP dual channel monitor and decodes

Log statistics to disk for a complete record of B-channel activity over time




## ISDN Monitoring Specifications

**D-channel Protocols**

**Layer 2:** LAPD per ITU-T Recommendation Q.921. SAPI 0 signalling, SAPI 16 X.25 packet and SAPI 63 LAPD management procedures supported.

**Layer 3: Q.931 variants**

| | | |
|---|---|---|
| ITR6 | ITU-T | QSIG |
| AT&T4ESS | DMS-100 | Siemens |
| AT&T5ESS | ETSI | SwissNet |
| AT&TNI-1 | JT-Q931 | Televerket |
| Australia | NI-1 | VN3 |
| Bellcore | NI-2 | VN4 |

**B-channel protocols**

**WAN:** LAP-B, X.25 Blue Book 1988, HDLC, SDLC, synchronous, async and multi-link PPP and LCP, Frame Relay (ANSI T1.606, ITU-T I.233, ANSI T1.617 Annex D, F & G, RFC 1490/RFC 2427, ITU-T Q.933, NTT), SNA, and SNAP.



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These can encapsulate any of the following LAN decodes:

LAN over WAN: 802.2, 802.3 and 802.5 MAC layer
TCP/IP: IP, TCP, UDP, RIP, OSPF, ICMP, SNMP, BOOTP, EGP, NETBLT, RFCNB, SUNRPC and TFTP
Novell: IPX, IPXFILE, IPXRIP, IPXSAP
DECNet: DNA, MOP XNS (IDP, SPP, RIP)
AppleTalk: AARP, AEP, ALAP, ATP, DDP, RTMP, ZIP
3Com: NetBIOS
IBM: SNA (FID0, FID2, FID4, RU, RH, Data Sense), NetBIOS, SMB
VoIP: H.323 series, IETF series (SIP, MGCP, SGCP, MEGACO)
FoIP: T.38

## ISDN Post Processing and Analysis

You can use the ISDN Internet Advisor's capture for post-processing analysis.

Post-processing display filters let you quickly zoom in on selected criteria, from the traffic passing between specific devices to individual conversations. With post-processing you can:
Search through the data by record or by time stamp
Search for events, specific types of frames, or frames associated with a calling or called number.
Verify event-to-event timing
View protocol errors
Print the current display or the entire buffer
Export data to other programs
Analyze statistics from the buffer data

You will spend less time searching through frames, and more time solving problems.

## Simulation and Emulation

Easy to use pre-written call placement scripts allow you to simply enter the called number and start testing connectivity as well as BERT over the B-channel to verify link integrity quickly.

Simulation script editor can be used to modify pre-written tests or create new ones. Simulate new devices, stress-test the network by placing multiple calls simultaneously, or customize test scenarios to meet specific requirements of your network.

The simulation script editor can also be used to modify and create simulation scripts for other WAN applications.



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## Searching and Triggering

On frame type — user defined, information, supervisory, unnumbered, RR, RNR, REJ, SABME, UI, DISC, DM, UA, FRMR, and XID.

On SAPI — call control SAPI 0, Q.931 SAPI 1, X.25 SAPI 16, layer 2 management SAPI 63, or user definable any SAPI value from 00 hex to FF hex.

On TEI value — enter any Hex value.

On LAP-D — command or response bit or poll/final bit and good, bad, or abort FCS.

On Q.931 — message types.

## Statistics

Maximum, instantaneous, and minimum utilization as percent, maximum, instantaneous, minimum, and average throughput in kbps; total octets, data segments, total frames, bad FCS's, abort frames, and short frames.

Pre-written statistics counters:

Message types — counts most Q.931 message types
D Channel Frames — counts
D-channel frames (LAP-D, Q.931, and X.25
LAPD frame counts
X.25 packet counts
Disconnect causes

**Note:** All counters are user- modifiable. Sixteen counters are available for TE and 16 for NT. All pre-written tests for PRI assume call reference length of 2 bytes; BRI tests assume a call reference length of 1 byte.

**Timing Measurements:**
Time stamp resolution 100 ns. Display time stamp with date.

**Bus Configuration:**
Point-to-point or passive bus connections

## Quickly Verify Call Placement Specifications

The Internet Advisor's ISDN simulation, call placement BERT testing, and numerous pre-written call placement scripts make verifying the proper operation of ISDN basic rate and primary rate circuits quick and easy.



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## BRI – Basic Rate Interface Simulation/Call Placement Specifications

Simulate:
TE (terminal equipment),
NT (network termination), or
LT (line termination)
Emulation:
LAP-D and partial Q.931
Bus Configuration:
Point-to-Point, Short Passive Bus and Extended Passive Bus
Handset Support - A-law and m-law on B1 or B2
Receiver Mode:
Terminated or Bridged
BERT Channel:
B1 - 56 kbps or 64 kbps
B2 - 56 kbps or 64 kbps
B1 and B2 - 112 kbps or 128 kbps
B1 (B2 Looped) - Full Duplex (B1 transmit to B2 receive, B2 receive to B2 transmit, B2 transmit to B1 receive)
B2 (B1 Looped) - Full Duplex (B2 transmit to B1 receive, B1 receive to B1transmit, B1 transmit to B2 receive)
B1 transmit to B2 receive
B2 transmit to B1 receive
TE Simulation Tests:
Place voice call
Place 56 kbps data call
Place 64 kbps data call
Place BERT call
B1 to B2 BERT Call - Place call and run a loopback BERT B1 to B2
Answer call
NT Simulation Tests:
Place voice call
Place 56 kbps data call
Place 64 kbps data call
Pre-written simulation test support:
ETSI, NI-1, JT-Q.931, ITU-T, AT&T 5ESS, AT&T NI-1, DMS-100, 1TR6, VN4, Siemens, and Australia

## PRI – Primary Rate Simulation and Call Placement Specifications

Simulate:
TE (terminal equipment) or
NT (network termination)
Emulation:
LAP-D and partial Q.931
Transmit Clock:
Recovered from line or internal/equipment In
Receiver Mode:
Terminated or bridged
Line Codes:
AMI, B8ZS, HDB3
Framing Types:
ESF, D4, G.704 alternate framing with or without CRC-4, fractional; channel (any multiple) 56 kbps or 64 kbps



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Handset Support:
A-law and m-law
Receiver Mode:
Terminated or Bridged
BERT Channel:
Select any B channel or Fraction
TE Simulation Tests:
Place voice call
Place 56 kbps data call
Place 64 kbps data call
Place BERT call
Answer call - Answer a call and run end-to-end BERT
NT Simulation Tests:
Place voice call
Place 56 kbps data call
Place 64 kbps data call
Pre-written simulation tests support:
ETSI, NI-1, JT-Q.931, ITU-T, AT&T 5ESS, AT&T 4ESS, AT&T NI-1, DMS-100, 1TR6, VN4, Siemens, and Australia

# X.25

## X.25/HDLC Decodes

The Internet Advisor WAN provides real-time decoding capability for all three layers of the X.25 protocol according to ITU-T X.25-1988. The following fields are decoded and displayed:
LAPB address, frame type, P/F, N(s), N(r), and FCS
X.25 GFI, LCN, packet type, P(s), and P(r)
called and calling addresses
facility fields
diagnostic, reset, and restart cause codes and explanations

## X.25 LCN Statistics

Displays first 32 LCNs (all data stored to capture buffer).
Display for each individual LCN:
Graph of instantaneous throughput
Number of frames in pie chart graphic.
Packet length distribution as a percent and total count.

## X.25 Test Scripts

DCE and DTE network cell
DCE and DTE subscriber call
Traffic generation
X.25 Call Placement Scripts
- Mode:
  * Simulate DTE or DCE
- Select:
  * Network call or subscriber call
  * logical channel number
  * calling and called number
- Emulation:
  * Level 2 and partial Level 3



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## PPP (Point to Point Protocol)

The Internet Advisor WAN provides decode capability for synchronous, asynchronous, and multi-link PPP.
The maximum speed for asynchronous PPP is 115.2 kbps. The following fields are decoded and displayed:
HDLC header-address, frame type and FCS
PPP header-protocol ID and CP code
LCP
NCP/NSCP, including IPCP, IPXCP, CCP, NetBIOS CP
PAP
CHAP
Multi-link PPP dual channel monitor and decodes
TCP tunneling
Top Talkers
Van Jacobsen compression

## SMDS (Optional)

The Internet Advisor WAN provides run-time and post processing display of the following decodes according to Bellcore TR-TSY-00772, 00773 and 00774 specifications:
Layer 1 PLCP
Layer 2 PDU
Layer 3 SMDS header
The following encapsulated protocols are decoded:
Frame Relay
X.25
HDLC
IP
SNAP

## ATM DXI

ATM DXI monitoring on V.24/V.28/RS-232C, RS-449/V.36, V.35, T1, E1, E3, DS3, HSSI

## V5.1/V5.2 Monitoring

V5.1 and V5.2 are interface standards defined by the European Telecommunication Standard Institute (ETSI) for interfaces between an Access Network (AN) and the Local Exchange (LE). The Internet Advisor WAN provides V5.1/V5.2 monitoring capabilities.
Layer 2 LAPV
Layer 3

## Physical Layer

**Line statistics**
The operation of the physical interface is often critical in determining the cause of network problems. Therefore, the Internet Advisor WAN tracks errors at the physical layer. Signal events are recorded on the display for both the line (network) side as well as the equipment (subscriber) side.



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Line status is displayed in real time (with 1 second resolution) All the events listed below are saved in the buffer and counted in the line status display. These events may be logged to disk. Critical parameters marked with an asterisk (*) are also displayed in large green or red boxes in the line status display, for easy, at-a-glance viewing.

Available measurements:

**T1/DS1**

Loss of signal (LOS) (*)
Loss of frame (LOF) (*)
Loss of PLCP sync (LOPS) (*)
AIS (*)
RAI/Yellow (X-bits) (*)
Bi-polar violations
ESF CRC errors
Line code violation (B8ZS)
Frame slips
Frame bits
One's density
Excess zero's
Loss of Cell Synchronization (*)

**E1**

Loss of Signal (LOS) (*)
Loss of Frame (LOF) (*)
Line code violations (HDB3)
RAI (FERF) (*)
AIS (*)
CRC-4 errors (if CRC-4 is selected)
Frame alignment error
Loss of Cell Synchronization (*)

**E3**

Loss of signal (LOS) (*)
Loss of frame (LOF) (*)
BIP-8
Line code violations (HDB3)
Payload type mismatch
REI (FEBE)
RDI (FERF)
AIS (*)
Loss of cell sync (LOCS) (*)

**T3/DS3**

Loss of Signal (LOS) (*)
Loss of Frame (LOF) (*)
Remote/Yellow (X-bits) (*)
AIS (*)
Line code violations (B8ZS)
FEBE
Idle (*)
P1/P2 parity errors
C-bit parity errors
PLCP sync loss (*)
PLCP Yellow (*)
PLCP BIP
PLCP FEBE
FEAC (*)
FEAC DS3 line
FEAC loss of signal/HBER
FEAC loss of frame
FEAC AIS
FEAC idle
FEAC service failure
FEAC no service failure
FEAC common equipment failure
FEAC line loopback activate
FEAC line loopback de-activate

**HSSI**

Data: SD
Data: RD
Status DCE ready: TA
Status DCE ready: CA
Loopback:
  A: CA
  B: LB
  C: LC
Test mode: TM
Clocks:
  ST: (from DCE)
  RT: (from DCE)
  TT: (from DTE)



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## BERT (Bit Error Rate Testing)

Many times problems on the network can often be attributed to the transmission medium. Although the physical medium may be good for normal data transmission, it may not be able to handle high-speed WAN data. That is why the Internet Advisor WAN has a powerful, built-in BERT (bit error rate tester).

### BERT Specifications for T1, E1, ISDN PRI T1 and E1, ISDN BRI S/T/U, DDS 4-Wire, V-Series

Transmit and receive framed and unframed bit patterns over single fractional or full bandwidth channels for T1, E1, ISDN primary rate interface (PRI) T1 and E1, basic rate interface (BRI) S/T/U:
- B1 or B2 at 56 or 64 kbps point-to-point B1 + B2 at 112 or 128 kbps point-to-point
- B1 with B2 looped full duplex
- B2 with B1 looped full duplex

Patterns:
- 63, 511, 2047 and 4095 PRBS $2^{15}$, $2^{20}$, $2^{23}$
- 3 in 24, 1 in 8 (1:7), 2 in 8
- all 1's, all 0's, 1010...(1:1)
- DDS1, DDS2, DDS3N, DDS4N, DDS5N, DDS6N, DDS3R, DDS5R, DDS V54LPDN, DDS/V54LPUP, OCT53, OCT54, OCT55, OCT55V2, OCT72, OCT96, OCT120, QRSS, and user defined patterns up to 996 bytes in hex or text

Standard pattern exception for E1:
- $2^{23}$ and $2^{15}$ inverted per ITU-T O.151

Block length:
- 511 bits, 1000 bits, 2047 bits

Duration:
- $10^5$ through $10^9$ bits
- 5, 10, 15 min.; 1, 4, 12, 24 hrs.; continuous

Data rate:
- User definable from 50 bps to 2.048 Mbps

Error insert rate:
- $10^2$ through $10^7$ or single error

Error insert type:
- Frame, Logic, BPV (Frame and BPV on T1 interface only)

BERT results include:
- Bit and block count
- Bit and block errors
- Bit error rate
- Errored second
- Error free seconds
- Percent error free seconds

Log Results:
- Disk

G.821 measurements - Reported, both in quantity and in percentage:
- Available time
- Errored seconds
- Degraded minutes
- Severely errored seconds
- Unavailable time

**Notes:**
BERT results can be logged at user-defined intervals and duration with each log entry carrying a real-time stamp with 100 ns resolution.
T1 standard loopback commands are generated and processed to simulate a CSU (channel service unit).



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## ASYNC, SYNC and Isoc BERT (V-Series Only)

Simulate:
DTE or DCE
DTE Clock:
DTE or DCE
Patterns:
63, 511, 2047 and 4095
PRBS
all 1's, all 0's, 1010...(1:1)
Fox, and user defined patterns up to 1024 bytes in hex or text
Flow Control:
None, Leads, Xon/Xoff pacing selectable
Log Results:
Off, Disk, Printer
Data Rates (bps):
50, 75, 110, 134.5, 150, 200, 300, 600, 1200, 1800, 2000, 2400, 3200, 3600, 4800, 7200, 9600, 19.2k, 14.4k, 38.4k, 48k, 56k, 64k (Selectable)
Framing:
None, 5 to 8 bits

## ISDN BERT Specifications

Patterns:
63, 511,2047, 4095, $2^{15}$-1, $2^{20}$-1, $2^{23}$-1, QRSS, All 1's, All 0's, 10101010(1:1) and any user defined pattern
User defined pattern can be hex or text up to 64 bytes in length
Standard pattern exception for ETSI-E1: $2^{23}$-1 and $2^{15}$-1 inverted per ITU-T O.151
Test Duration:
5, 10, 15 minutes, 1, 4, 12, 24 hours, or continuous
Error insert type:
Logic, BPV, and frame
Error insert rate:
1 in $10^3$, 1 in $10^4$, 1 in $10^5$, 1 in $10^6$, 1 in $10^7$
BERT Results:
Errored seconds
Errored free Seconds
Percent error free seconds
Total bits received count
Total bit errors
Bit error rate
G.821 available time
G.821 errored seconds
G.821 degraded minutes
G.821 severely errored seconds
G.821 unavailable time
Logging:
All BERT results may be logged to the hard drive at intervals from 1 minute up to 999 hours.
Additional T1 BERT results:
Total BPVs
ESF CRC errors
Frame bit errors
Frame slips
Additional E1 results:
Total BPVs
CRC errors
Frame bit errors



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T1 interface indication:
Loss of signal, frame sync, B8ZS detect, BPV, ESF CRC errors, framing bit errors, frame slip, pulse density violation, yellow/remote alarm.
E1 interface indication:
Loss of signal, frame synch, like code violation, BPV, CRC-4 bit errors, frame alignment signal, far end block error, remote alarm, AIS/all 1's.

### BERT for E3/DS3

1111, 1010, 1100, $2^{15}$-1, $2^{20}$-1, $2^{23}$-1
User defined: one octet (8bits)
Duration:
Continuous or user definable from 1 minute to 1000 hours
Errors:
Logic, Code, Frame, P1/P2 bit parity FEBE, FEAC
Error insert rate:
Programmable from $10^3$ to $10^9$

## ATM and WAN Interface Specifications

Unless otherwise stated, ATM and WAN interfaces provide two input ports and two output ports allowing any one of the following connection configurations to be used:

- Terminal Mode - uses one input and one output
- Bridged Monitor Mode - uses both inputs and outputs for bi-directional monitoring at test access points; a high input impedance should normally be selected
- Jack Monitor Mode – uses both inputs only for bi-directional monitoring at protected monitor points
- Through Monitor Mode - uses both inputs and outputs providing bi-directional repeater functionality plus bi-directional monitoring functionality. Each receiver input is terminated

The operation of the physical interface is often critical in determining the cause of network problems. Therefore, the Internet Advisor tracks errors at the physical layer, and it stamps the information with a 1 ms time stamp. Signal events are recorded on the display for both the line (network) side as well as the equipment (user/subscriber) side. The time of the last occurrence of a particular event is recorded as well. Events are saved in the buffer and can be logged to disk.

Line status is displayed in real time. All of the events listed in the "Physical layer alarms and statistics" section for each interface below are saved in the buffer and counted in the line status display. These events may be logged to disk. Critical parameters marked with an asterisk (*) are also displayed in large green or red boxes in the line status display for easy "at-a-glance" viewing.

### T1/DS1 (1.544 Mb/s)

**General**
This interface comprises a choice of two plug-in modules (J2298B and J2299B) suitable for plugging into the J2300C/D Internet Advisor mainframe and the J2900A High Speed undercradle. The J2298B has RJ-48C connectors and the J2299B has RJ-45 connectors. The modules handle cell and frame-based technologies, i.e. ATM, Frame Relay, ISDN, HDLC, X.25, PPP, and BERT.

**Common to Inputs and Outputs:**
Connectors:
J2298B: balanced 100 Ohm RJ-48C and WECO mini-Bantams
J2299B: balanced 100 Ohm RJ-45 and WECO mini-Bantams
Line Code:
ATM: B8ZS
WAN: B8ZS, AMI



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Framing:
ATM:
Extended Super Frame (ESF)
WAN:
Extended Super Frame (ESF)
D4 (Super Frame) Ft and Fs, or Fs only
Fractional, any multiple of 56 kbps or 64 kbps channels
DS0A and DS0B subrates from a single 56 kbps timeslot
Unframed 1.544 Mbps
Cell Mapping:
Direct (normal mode, ITU-T G.804) and PLCP (obsolete mode)
Cell Scrambling:
Conforms to ITU-T I.432.1 ($x^{43} + 1$) and may be turned on or off
Inputs:
Two ports
Interface types (and input sensitivities):
DSX-1 (+6 dB to –10 dB ) and Network Interface (+6 dB to -36 dB )
Monitor modes:
Terminated (100 Ohm)
Bridged (High Impedance)
Monitor Jack
Physical Layer Alarms and Statistics:
Loss of Signal (LOS)
Loss of Frame (LOF)
Loss of PLCP Synchronization (LOPS)
Alarm Indication Signal (AIS)
Remote Alarm Indication (RAI)/Yellow
Bi-polar violations
Extended Super-Frame (ESF) CRC errors
Line code violation
Frame slips
Frame bit errors
One's density violations
Excess zero's
Loss of Cell Delineation (LCD)
ATM Layer Statistics:
Average utilization in percent
Instantaneous utilization in percent
Total cells received
Idle/unassigned cells received
Busy (assigned) cells received
Header ("HEC") errors
Capture buffer size: 28 Mbyte (approximately 400,000 cells)
Capture buffer timestamp resolution: 100 ns
Capture rate: Full line rate

**Outputs:**
Two ports, 100 Ohm balanced
RJ-11 handset jack (for WAN)
Interface types (and output levels):
DSX-1 (build-out selectable from 0 to 655 ft in 5 steps) and Network Interface (selectable LBO levels, 0, -7.5 dB and -15.0 dB)
Electrical:
ITU-T G.703
Clocking:
Recovered (loop), Internal and External using other receiver input
Internal clock rate accuracy:
+/- 32 ppm
Traffic Generation from cell table
Transmission of bit error rate (BER) patterns in the physical layer frame payload or in the ATM cell payload:
1111, 1010, 1100, PRBS $2^{15}$ - 1, PRBS $2^{20}$ - 1, PRBS $2^{23}$ – 1
Transmission of 64-bit BER user pattern in WAN



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## E1 (2.048 Mb/s)

**General**
This interface comprises a choice of two plug-in modules (J2294C and J2296B) suitable for plugging into the J2300C/D Internet Advisor mainframe and the J2900A High Speed undercradle. The J2294C has RJ-45 and DB-9 connectors which, with converter cables, can connect to 120 Ohm Small Siemens connectors; the J2296B has 75 Ohm BNC connectors. The modules handle cell and frame-based technologies, i.e. ATM, Frame Relay, ISDN, HDLC, X.25, PPP and BERT.

**Common to Inputs and Outputs:**
Connectors:
J2294C: balanced 120 Ohm DB-9 and RJ-45
J2296B: unbalanced 75 Ohm BNC female
Line Code:
ATM: HDB3
WAN: HDB3, AMI
Electrical:
ITU-T G.703
Framing:
ATM:
ITU-T G.704 alternate framing with or without CRC-4
WAN:
ITU-T G.704 alternate framing with or without CRC-4
Fractional channel, any multiple of 64 kbps channel
Unframed at 2.048 Mbps
Cell Mapping:
Direct (ITU-T G.804)
Cell Scrambling:
Conforms to ITU-T I.432.1 ($x^{43} + 1$) and may be turned on or off

**Inputs:**
Two ports
Levels:
ITU-T G.703
Monitor modes:
Terminated, 120 Ohm balanced (J2294C)
Bridged (High Impedance)
Terminated, 75 Ohm unbalanced (J2296B)
Monitor Jack -20 dB and -30 dB
Physical Layer Alarms and Statistics:
Loss of Signal (LOS)
Loss of Frame (LOF)
Alarm Indication Signal (AIS)
Remote Alarm Indication (RAI)
Line code violations
CRC-4 errors (if CRC-4 is selected)
Frame alignment error
Loss of Cell Delineation (LCD)
ATM Layer Statistics:
Average utilization in percent
Instantaneous utilization in percent
Total cells received
Idle/unassigned cells received
Busy (assigned) cells received
Header ("HEC") errors
Capture buffer size: 28 Mbyte (approximately 400,000 cells)
Capture buffer timestamp resolution: 100 ns
Capture rate: Full line rate


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**Outputs:**
Two ports, 75 Ohm unbalanced (J2296B) or 120 Ohm balanced (J2294C)
Levels:
ITU-T G.703
Clocking:
Recovered (loop), Internal and External (using other receiver input)
Internal clock rate accuracy:
+/- 50 ppm
Traffic Generation from cell table
Generation of bit error rate (BER) patterns in the physical layer frame payload or in the ATM cell payload:
1111, 1010, 1100, PRBS $2^{15}$ - 1, PRBS $2^{20}$ - 1, PRBS $2^{23}$ – 1
Transmission of 64-bit BER user pattern in WAN

## ATM25 (25.600 Mb/s)

**General**
This interface comprises a plug-in module (J3766A) suitable for plugging into the J2300C/D Internet Advisor mainframe and J2900A High Speed undercradle.

**Common to Inputs and Outputs:**
Main Specifications: ATM Forum af-phy-0040.000, ITU-T I.432.5
Ports: Two bi-directional, one towards the equipment and the other towards the network: 100 Ohm (for UTP-3 cable) and 120 Ohm (for UTP-5 cable)
Test configuration modes:
Terminal (towards network or equipment) and Monitor (both directions for protocol analysis with repeater functionality in each direction)
Connectors: RJ-45 (UTP)
Line Code: NRZI
Symbol Coding: 4B5B
Line Symbol Rate: 32 Mbaud
Cell Mapping: Symbolic direct (i.e. no framing)
Cell Scrambling: Conforms to af-phy-0040.000 ($x^{10} + x^7 + 1$)

**Inputs**:
Physical Layer Alarms and Statistics:
Invalid symbol
Short cell
Loss of signal (LOS)
Loss of Timing Synchronization
Timing synchronization frequency
ATM Layer Statistics:
Average utilization in percent
Instantaneous utilization in percent
Total cells received
Idle/unassigned cells received
Busy (assigned) cells received
Header (“HEC”) errors
Analyze bit error rate (BER) patterns in the ATM cell payload:
1111, 1010, 1100, PRBS $2^{15}$ - 1, PRBS $2^{20}$ - 1, PRBS $2^{23}$ - 1
ATM QoS Measurements (to ITU-T O.191):
CLR, CMR, CER, CDV, CTD, SECBR
Traffic contract conformance (policing):
CBR.0 (PCR 0+1, PCR CLP = 0);
CBR.1/DBR/UBR.1 (PCR CLP = 0+1);
VBR.1/SBR1 (PCR CLP = 0+1, SCR CLP = 0+1 without tagging);
VBR.2/SBR2 (PCR CLP = 0+1, SCR CLP = 0 without tagging);
VBR.3/SBR3 (PCR CLP = 0+1, SCR CLP = 0+1 with tagging)
Capture buffer size: 64 Mbyte (approximately 1,000,000 cells)
Capture buffer timestamp resolution: 100 ns
Capture rate: Full line rate



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**Outputs:**
QoS and X8 timing source:
Recovered from line (loop), recovered from X8 8 kHz time synchronization source, and internal
Internal clock rate accuracy: +/- 50 ppm
Optional generation of X8 8 kHz time synchronization symbol pair
Simulate network or user equipment
Generate bit error rate (BER) patterns in the ATM cell payload:
1111, 1010, 1100, PRBS $2^{15}$ - 1, PRBS $2^{20}$ - 1, PRBS $2^{23}$ - 1
Generate Test Cell traffic (ITU-T O.191) shaped to traffic contract

## E3 (34.368 Mb/s)

**General**
This interface comprises a plug-in module (J3759B) suitable for plugging into the J2300C/D Internet Advisor mainframe and the J2900A High Speed undercradle. It supports both ATM and frame-based technologies (Frame Relay, HDLC, PPP). This module can also be configured for use as a DS3 (44.736 Mb/s) interface; see below for details.

**Common to Inputs and Outputs:**
Connectors: 75 Ohm BNC female
Electrical: ITU-T G.703
Line Code: HDB3
Framing:
Frame Relay: ITU-T G.751
ATM Direct: ITU-T G.832
ATM PLCP: ITU-T G.751
Cell Mapping:
Direct (normal mode, ITU-T G.804)
PLCP (obsolete mode, ETSI 300 214)
Cell Scrambling:
Conforms to ITU-T I.432.1 ($x^{43} + 1$) and may be turned on or off

**Inputs**:
Two ports
Levels:
Auto gain control for high, low and monitor jack; all unbalanced 1.2Vpeak to 26mVpeak, 34 dB dynamic range
Received pulse amplitude measurement (mVpeak) (WAN only)
Monitor modes:
Terminated/Repeater (75 Ohm unbalanced)
Bridged (high impedance)
Physical Layer Alarms and Statistics:
Loss of Signal (LOS)
Loss of Frame (LOF)
Line code violations
Alarm Indication Signal (AIS)
Remote Defect Indication (RDI), formerly known as FERF
Remote Error Indication (REI), formerly known as FEBE
Bit Interleave Parity (BIP-8)
Payload type mismatch
Loss of Cell Delineation (LCD)
ATM Statistics:
Average utilization in percent
Instantaneous utilization in percent
Total cells received
Idle/unassigned cells received
Busy (assigned) cells received
Header ("HEC") errors


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Frame Relay Statistics:
- Average utilization in percent
- Instantaneous utilization in percent
- Maximum utilization in percent
- Minimum utilization in percent
- Total frames
- Total octets
- Average throughput (bps)
- Instantaneous throughput (bps)
- Maximum throughput (bps)
- Minimum throughput (bps)
- Aborted frames
- Short frames
- FCS errors

Analyze bit error rate (BER) patterns in the physical layer frame payload or in the ATM cell payload:
1111, 1010, 1100, PRBS $2^{15}$ - 1, PRBS $2^{20}$ - 1, PRBS $2^{23}$ - 1

ATM QoS Measurements (ITU-T O.191):
CLR, CMR, CER, CDV, CTD, SECBR

Traffic contract conformance (policing):
- CBR.0 (PCR 0+1, PCR CLP = 0);
- CBR.1/DBR/UBR.1 (PCR CLP = 0+1);
- VBR.1/SBR1 (PCR CLP = 0+1, SCR CLP = 0+1 without tagging);
- VBR.2/SBR2 (PCR CLP = 0+1, SCR CLP = 0 without tagging);
- VBR.3/SBR3 (PCR CLP = 0+1, SCR CLP = 0+1 with tagging)

Capture buffer size: 64 Mbyte (approximately 1,000,000 cells)
Capture buffer timestamp resolution: 100 ns
Capture rate: Full line rate

**Outputs:**
Two ports, 75 Ohm unbalanced
Levels:
- ITU-T G.703
- High (1.0 Vpeak)
- 137 m / 450 ft (0.62 Vpeak)
- 275 m / 900 ft (0.26 Vpeak)

Clocking source (Tx bit clock and ATM QoS):
- Recovered (loop)
- Internal (± 20 ppm)

Alarm generation:
- Remote Defect Indication (RDI), formerly known as FERF
- Alarm Indication Signal (AIS)

Simulate line or equipment
Generate Test Cell traffic (ITU-T O.191) shaped to traffic contract (as in traffic contract conformance, above)
Generate from cell table
Generate bit error rate (BER) patterns in the physical layer frame payload or in the ATM cell payload:
1111, 1010, 1100, PRBS $2^{15}$ - 1, PRBS $2^{20}$ - 1, PRBS $2^{23}$ – 1



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## DS3 (44.736 Mb/s)

**General**
This interface comprises a plug-in module (J3759B) suitable for plugging into the J2300C/D Internet Advisor mainframe and the J2900A High Speed undercradle. It supports both ATM and frame-based technologies (Frame Relay, HDLC, PPP). This module can also be configured for use as an E3 (34.368 Mb/s) interface; see above for details.

**Common to Inputs and Outputs:**
Connectors: 75 Ohm BNC female
Electrical: ITU-T G.703
Line Code: B3ZS
Framing:
  Frame Relay: C-bit and M13 (auto-select on input side)
  ATM: C-bit framing
Cell Mapping:
  Direct (normal mode, ITU-T G.804)
  PLCP (obsolescent mode, ITU-T G.804)
Cell Scrambling:
  conforms to ITU-T I.432.1 ($x^{43} + 1$) and may be turned on or off

**Inputs:**
Two ports,
Levels:
  Auto gain control for high, DSX-3, low, and monitor jack
  (min. = DSX -23 dB); all unbalanced 1.2 V peak to 26 mV,
  34 dB dynamic range
Received pulse amplitude measurement (mVpeak) (WAN only)
Monitor modes:
  Terminated/Repeater (75 Ohm)
  Bridged (high impedance)
Physical Layer Alarms and Statistics:
  Loss of Signal (LOS)
  Loss of Frame (LOF)
  Alarm Indication Signal (AIS)
  Remote/yellow X-bit
  Line code violations
  Far End Block Error (FEBE)
  Idle
  P1/P2 parity errors
  C-bit parity errors
  Far End Alarm and Control (FEAC):
    DS3 Line
    LOS/HBER
    Out of Frame (OOF)
    AIS received
    Idle signal received
    Service failure
    No service failure
    Common equipment failure
    Line loopback activate
    Line loopback de-activate
  PLCP sync loss
  PLCP yellow (Path FERF)
  PLCP BIP
  PLCP FEBE
  Loss of Cell Delineation (LCD)



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ATM Statistics:
- Average utilization in percent
- Instantaneous utilization in percent
- Total cells received
- Idle/unassigned cells received
- Busy (assigned) cells received
- Header ("HEC") errors

Frame Relay Statistics:
- Average utilization in percent
- Instantaneous utilization in percent
- Maximum utilization in percent
- Minimum utilization in percent
- Total frames
- Total octets
- Average throughput (bps)
- Instantaneous throughput (bps)
- Maximum throughput (bps)
- Minimum throughput (bps)
- Aborted frames
- Short frames
- FCS errors

Analyze bit error rate (BER) patterns in the physical layer frame payload or in the ATM cell payload:
1111, 1010, 1100, PRBS $2^{15}$ - 1, PRBS $2^{20}$ - 1, PRBS $2^{23}$ - 1

ATM QoS Measurements (ITU-T O.191):
CLR, CMR, CER, CDV, CTD, SECBR

Traffic contract conformance (policing):
- CBR.0 (PCR 0+1, PCR CLP = 0);
- CBR.1/DBR/UBR.1 (PCR CLP = 0+1);
- VBR.1/SBR1 (PCR CLP = 0+1, SCR CLP = 0+1 without tagging);
- VBR.2/SBR2 (PCR CLP = 0+1, SCR CLP = 0 without tagging);
- VBR.3/SBR3 (PCR CLP = 0+1, SCR CLP = 0+1 with tagging)

Capture buffer size: 64 Mbyte (approximately 1,000,000 cells)
Capture buffer timestamp resolution: 100 ns
Capture rate: Full line rate

**Outputs:**
Two ports, 75 Ohm unbalanced
Transmit levels/line build-out (±100 mV):
- High (0.85 V peak)
- DSX (0.45 V peak)*
- Low (0.36 V peak)*
- 900ft. (0.12 V peak)*
- * selectable in frame mode (FR, PPP, HDLC) only

Clocking source (Tx bit clock and ATM QoS):
- Recovered (loop)
- Internal (± 20 ppm)

Alarm generation:
- Remote/Yellow (X-bits),
- Alarm Indication Signal (AIS)
- Idle

Simulate line or equipment
Generate Test Cell traffic (ITU-T O.191) shaped to traffic contract (as in traffic contract conformance, above)
Generate from cell table
Generate bit error rate (BER) patterns in the physical layer frame payload or in the ATM cell payload:
1111, 1010, 1100, PRBS $2^{15}$ - 1, PRBS $2^{20}$ - 1, PRBS $2^{23}$ – 1



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## STM-1/OC-3c (155.520 Mb/s)

**General**
This interface comprises a plug-in module (J2912B) suitable for plugging into the J2300C/D Internet Advisor mainframe and J2900A High Speed undercradle.
**Common to Inputs and Outputs:**
Connectors: SC-PC
Framing:
SDH: STM-1
SONET: STS-3c
Frame Scrambling:
STM-1: ITU-T G.707
SONET: ANSI T1.105
Cell Scrambling: conforms to ITU-T I.432.1 ($x^{43} + 1$) and may be turned on or off

**Inputs**:
Two ports (single-mode/multi-mode compatible)
Sensitivity:
Typ. -32 dBm
Min. -28 dBm
Loss of Signal Detect Level:
-34 dBm
Real-time optical power measurement (can also be used to measure at 622Mb/s):
+3 dBm to -42 dBm dynamic range
+/-0.5 dB absolute accuracy
Physical layer alarms and statistics (SDH / SONET):
Loss of Signal (LOS) (*)
Loss of Frame (LOF) (*)
B1, B2, B3 BIP errors
Summary BIP error (*)
MS-REI / REI-L (Line FEBE)
REI / REI-P (Path FEBE)
MS-AIS / AIS-L (*)
RDI / RDI-P (Yellow)
AIS / AIS-P
Summary Far End (*)
Loss of Cell Delineation (LCD) (*)
ATM layer statistics:
Average utilization in percent
Instantaneous utilization in percent
Total cells received
Idle/unassigned cells received
Busy (assigned) cells received
Header ("HEC") errors
Analyze bit error rate (BER) patterns in the physical layer frame payload or in the ATM cell payload:
1111, 1010, 1100, PRBS $2^{15} - 1$, PRBS $2^{20} - 1$, PRBS $2^{23} - 1$
ATM QoS Measurements (to ITU-T O.191):
CLR, CMR, CER, CDV, CTD, SECBR
Traffic contract conformance (policing):
CBR.0 (PCR 0+1, PCR CLP = 0);
CBR.1/DBR/UBR.1 (PCR CLP = 0+1);
VBR.1/SBR1 (PCR CLP = 0+1, SCR CLP = 0+1 without tagging);
VBR.2/SBR2 (PCR CLP = 0+1, SCR CLP = 0 without tagging);
VBR.3/SBR3 (PCR CLP = 0+1, SCR CLP = 0+1 with tagging)


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Capture buffer size: 64 Mbyte (approximately 1,000,000 cells)
Capture buffer timestamp resolution: 100 ns
Capture rate: Full line rate

**Outputs:**
Two ports, 1310nm Class 1 laser (multi-mode fiber compatible with 10 dB attenuator, available separately as J2928A)
Output levels:
Min. -12 dBm
Max. -7 dBm
Clocking: Internal (± 20 ppm)
Alarm Generation:
MS-RDI / RDI-L (Line FERF)
MS-AIS / AIS-L
RDI / RDI-P (Yellow)
AIS / AIS-P
Generate bit error rate (BER) patterns in the physical layer frame payload or in the ATM cell payload:
1111, 1010, 1100, PRBS $2^{15}$ - 1, PRBS $2^{20}$ - 1, PRBS $2^{23}$ - 1
Generate Test Cell traffic (ITU-T O.191) shaped to traffic contract

## STM-1e (155.520 Mb/s)*

**General**
This interface comprises a plug-in module (J2914A) suitable for plugging into the J2300C/D Internet Advisor mainframe and J2900A High Speed undercradle.

**Common to Inputs and Outputs:**
Connectors: 75 Ohm BNC, unbalanced
Electrical: ITU-T G.703
Line Code: CMI
Framing: SDH STM-1, ITU-T G.707
Cell Scrambling: conforms to ITU-T I.432.1 ($x^{43} + 1$) and may be turned on or off

**Inputs**:
Two ports
Terminal mode
Monitor Mode: automatic gain control (0 dB or 12 dB gain) to ITU-T G.772 (protected monitor point specification)
Received pulse amplitude measurement (mVpeak)
Physical layer alarms and statistics:
Loss of Signal (LOS) (*)
Loss of Frame (LOF) (*)
Loss of Pointer (LOP)
Line Code Violations
B1, B2, B3 BIP errors
Summary BIP error (*)
MS-REI
REI
MS-RDI (*)
MS-AIS (*)
RDI
AIS
Summary Far End (*)
Loss of Cell Delineation (LCD) (*)



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ATM QoS Measurements (to ITU-T O.191):
CLR, CMR, CER, CDV, CTD, SECBR
Traffic contract conformance (policing):
CBR.0 (PCR 0+1, PCR CLP = 0);
CBR.1/DBR/UBR.1 (PCR CLP = 0+1);
VBR.1/SBR1 (PCR CLP = 0+1, SCR CLP = 0+1 without tagging);
VBR.2/SBR2 (PCR CLP = 0+1, SCR CLP = 0 without tagging);
VBR.3/SBR3 (PCR CLP = 0+1, SCR CLP = 0+1 with tagging)
Capture buffer size: 64 Mbyte (approximately 1,000,000 cells)
Capture buffer timestamp resolution: 100 ns
Capture rate: Full line rate

**Outputs:**
Two ports
Output levels: 1.0 V ± 0.1V
Clocking:
Internal (± 20 ppm)
Recovered from input signal
Alarm Generation:
MS-AIS
RDI
AIS
Generate bit error rate (BER) patterns in the physical layer frame payload or in the ATM cell payload:
1111, 1010, 1100, PRBS $2^{15}$ - 1, PRBS $2^{20}$ - 1, PRBS $2^{23}$ - 1
Generate Test Cell traffic (ITU-T O.191) shaped to traffic contract

* This plug-in module will be supported with the release following 11.3

## UTP155 (155.520 Mb/s)

**General**
This interface comprises a plug-in module (J2913B) suitable for plugging into the J2300C/D Internet Advisor mainframe and J2900A High Speed undercradle.

**Common to Inputs and Outputs:**
Main Specification:
ATM Forum af-phy-0015.000
Connectors: RJ-45 (UTP)
Line Code: NRZ
Framing: SONET: STS-3c
Frame Scrambling: SONET: ANSI T1.105
Cell Scrambling conforms to ITU-T I.432.1 ($x^{43} + 1$)

**Inputs**:
Two ports, one towards the user, one towards the network,
100 Ohm and 120 Ohm
Monitor modes:
Terminated
Physical layer alarms and statistics (SONET based):
Loss of Signal (LOS) (*)
Loss of Frame (LOF) (*)
Loss of Pointer (LOP)
B1, B2, B3 BIP errors
Summary BIP error (*)
REI-L (Line FEBE)
REI-P (Path FEBE)
RDI-L (Line FERF) (*)
AIS-L (*)
RDI-P (Yellow)
AIS-P
Summary Far End (*)
Loss of Cell Delineation (LCD) (*)



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ATM layer statistics:
Average utilization in percent
Instantaneous utilization in percent
Total cells received
Idle/unassigned cells received
Busy (assigned) cells received
Header ("HEC") errors
Analyze bit error rate (BER) patterns in the physical layer frame payload or in the ATM cell payload:
1111, 1010, 1100, PRBS $2^{15}$ - 1, PRBS $2^{20}$ - 1, PRBS $2^{23}$ - 1
ATM QoS Measurements (to ITU-T O.191):
CLR, CMR, CER, CDV, CTD, SECBR
Traffic contract conformance (policing):
CBR.0 (PCR 0+1, PCR CLP = 0);
CBR.1/DBR/UBR.1 (PCR CLP = 0+1);
VBR.1/SBR1 (PCR CLP = 0+1, SCR CLP = 0+1 without tagging);
VBR.2/SBR2 (PCR CLP = 0+1, SCR CLP = 0 without tagging);
VBR.3/SBR3 (PCR CLP = 0+1, SCR CLP = 0+1 with tagging)
Capture buffer size: 64 Mbyte (approximately 1,000,000 cells)
Capture buffer timestamp resolution: 100 ns
Capture rate: Full line rate
Outputs:
Two ports, one towards the user, one towards the network,
100 Ohm and 120 Ohm
Clocking: Internal (± 20 ppm)
Alarm Generation:
AIS-L
RDI-P (Yellow)
AIS-P
Simulate network or user equipment
Generate bit error rate (BER) patterns in the physical layer frame payload or in the ATM cell payload:
1111, 1010, 1100, PRBS $2^{15}$ - 1, PRBS $2^{20}$ - 1, PRBS $2^{23}$ - 1
Generate Test Cell traffic (ITU-T O.191) shaped to traffic contract

## STM-4c/OC-12c (622.080 Mb/s)

**General**
This interface comprises an undercradle (J3763A) for the Internet Advisor with a choice of single-mode optics plug-in module (J3764A) or multi-mode plug-in optics module (J3765A).

**Common to Inputs and Outputs:**
Connectors: SC
Framing:
SDH: STM-4c
SONET: STS-12c
Frame Scrambling:
STM-1: ITU-T Rec.G.707
SONET: ANSI T1.105
Cell Scrambling conforms to I.432.1 ($x^{43} + 1$) and may be turned on or off

**Inputs:**
With single-mode optics plug-in module J3764A:
Two ports (single-mode/multi-mode compatible)
Sensitivity:
Typ. –30 dBm
Min. –28 dBm
Loss of Signal (LOS) Detect Level: -39 dBm
With multi-mode optics plug-in module J3765A:
Two ports (single-mode/multi-mode compatible)
Sensitivity: Typ. –26 dBm
Loss of Signal (LOS) Detect Level: -45 dBm



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Physical layer alarms and statistics (SDH / SONET):
- Loss of Signal (LOS)
- Loss of Frame (LOF)
- Loss of Pointer (LOP)
- Out of Frame (OOF)
- B1, B2, B3 BIP error counts
- BIP error indication
- MS-REI and counts / REI-L (Line FEBE)
- REI and counts / REI-P (Path FEBE)
- MS-RDI / RDI-L (Line FERF)
- MS-AIS / AIS-L
- RDI/ RDI-P (Yellow)
- AIS / AIS-P
- Signal label mismatch
- Loss of Cell Delineation (LCD)

ATM Statistics:
- Auto-discovery of up to 4,095 virtual channels (VC)
- Instantaneous utilization in percent per VC
- Peak percentage of total bandwidth per VC
- Total cells received per VC
- Header ("HEC") errors

Capture buffer size: 64 Mbyte (approximately 1,000,000 cells)
Capture buffer timestamp resolution: 100ns
Capture rate: full line rate
Pre-capture filtering:
- By VPI-VCI (UNI or NNI), including/excluding idle/unassigned cells, by PTI and/or CLP; up to three different VPI-VCI filters can be specified; cells with bad HECs can also be filtered

Display (post-capture) filtering by:
- VCC: VPI-VCI (UNI or NNI), errored headers ("HEC" errors)
- IP source and/or destination address in PDUs conforming to RFC 1483, RFC1577 or LANE
- Decode: same as for display decodes (below)

Display decodes include:
- AAL-3/4, AAL-5, OAM, ILMI, RM
- Q.2110 SSCOP (for UNI Sig. 3.1), Q.SAAL1 SSCOP (for UNI Sig. 3.0),
- UNI Signalling (3.0, 3.1), SPANS, LANE (1.0 and 2.0), MPOA, PNNI,
- Frame Relay network interworking (FRF.5), MPEG2,
- 802.1d (Spanning Tree), 802.2, 802.3, Ethernet, 802.5,
- ARP (inc. Inverse ARP), BGP (Keep Alive),
- BOOTP, DNS, GSMP, ICMP, IFMP, IP, IPX, LLC/SNAP, NHRP, OSPF,
- RIP, SAP, SNAP, SNMP, TCP, TFTP, Telnet, UDP

Other LAN decodes (including Internet Advisor "Commentators"):
- TCP/IP, Novell, IBM, AppleTalk, Xerox, Banyan, Oracle, Sybase, OSI, DECNet

QoS measurements:
- Test cell analysis for cell loss, misinsertion, CDV tolerance threshold (note: test-cell generation does not conform to ITU-T O.191)

**Outputs:**

With single-mode optics plug-in module J3764A:
- Two ports, 1310nm Class 1 single-mode laser (multi-mode fiber compatible with 10 dB attenuator, sold separately)
- Output levels:
  - Min. -15 dBm
  - Typ. -13 dBm
  - Max. -8 dBm
- Clocking:
- Recovered (loop) and Internal

With multi-mode optics plug-in module J3765A:
- Two ports, 1270 nm - 1380 nm LED (output unsuitable for single-mode optics environment)



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Output levels: Min. -19 dBm
Clocking: Recovered (loop) and Internal
Generation:
a single cell
from a script of multiple cells
from a previously captured cell trace
from imported files
send PING (ICMP Echo) - AAL-5 encapsulated RFC1483 and RFC1577
QoS test cell generation (note: test-cell generation does not conform to ITU-T O.191

## HSSI (50 kb/s - 52 Mb/s)

**General**
This interface comprises a plug-in module (J3762B) suitable for plugging into the J2300C/D Internet Advisor mainframe and J2900A High Speed undercradle.

**Common to Inputs and Outputs:**
Connectors:
Two 50 pin SCSI (one to DCE, one to DTE)
Type:
Latch Blocks without rails
Clocking:
Recovered or
Internal (selectable from 50 kbps - 52 Mbps)
Control Signal:
DCE: CA, TM
DTE: TA
Loop Control:
DTE: None, Local DTE, Local Line, Remote Line
DCE: LC
Electrical:
EIA-612
EIA-613
Monitored:
Signal:
DTE: SD
DCE: RD
Clock:
From DCE: ST, RT
From DTE: TT
Status:
DCE Ready: TA
DTE Ready: CA
Loopback:
A: LA
B: LB
Test Mode: TM



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## V-Series Interfaces

**General**
V.10/V.11, V.24/V.28/RS-232C, V.35 and V.36/RS-449/422/423 are built into the J2300D mainframe; X.21 (with J2277A external cable – V.36/RS-449 to DB15) and RS-530 (with external cable J2278A – V.36/RS-449 to DB25) are also available.

**Detail**
Bit rates:
Sync or Sync NRZI, 50 bps to 2.048 Mbps on V.35, V.36/RS-449/422/423/530 and X.21
Sync or Sync NRZI, 50 bps to 256 kbps on V.24/V.28/RS-232C
Async, 50 bps to 256 kbps
Lead status:
RTS, CTS, DTR, DSR, and CD (V.24/V.28/RS-232C and V.35)
CS, RS, RR, TR, and DM (V.10/V.11 and V.36/RS-449/422/423)

## DDS 4-wire

**General**
This interface comprises a plug-in module (J2908A) suitable for plugging into the J2300C/D Internet Advisor mainframe or J2900A High Speed undercradle. This WAN module can be used with T1 Digital Data Systems (DDS) circuits to monitor and decode the data traffic of individual DDS subrate users. The module is only available in the United States of America.

**Input**
Connectors:
RJ48s
Demultiplexed access:
Timeslots 1-24 on T1 lines using D4 or ESF framing
Timeslots 1-23 on DDS lines using T1 DM framing
Rates:
DS0A, single user:
2.4, 4.8, 9.6, 19.2, 38.4, and 56 kbps (error corrected 19.2 kbps not supported)
DS0B:
2.4, 4.8 and 9.6 kbps in 20, 10 and 5 user positions respectively 19.2, 28.8 and 38.4 kbps multiplexed intermediate rates in any adjacent combination of five 9.6 kbps channels.
Standards:
ANSI T1.107 – 1988, Digital Hierarchy Synchronous Digital Data Format
ANSI T1.107b – 1991 Supplement to ANSI T1.107
AT&T TR 54075 Subrate Data Multiplexing for Digital Data Systems
CB-INC-101 Compatibility Bulletin, Integrated Network Corporation, 38.4 kbps DDS Equipment, June 1988


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### ISDN Basic Rate Interface (BRI) S/T/U

**General**
This interface comprises a pair of plug-in modules (J2904B and J2905B) suitable for plugging into a J2300C/D Internet Advisor mainframe or J2900A High Speed undercradle. The J2904B handles the S and T interfaces while the J2905B handles the S, T and U interfaces.

**Common to Inputs and Outputs**
Connectors:
- RJ-45
- RJ-11 handset jack

Voice coding supported:
- a-law & m-law

Standards:
- BRI S/T: ITU-T I.430, ETSI ETS 300 012, ANSI T1.605
- BRI U: 2B1Q ANSI T1.601 – 1992, ETSI ETR 80, ITU-T G.960/961

Data Rates:
- D channel: 16 kbps
- B1 channel: 56 or 64 kbps
- B2 channel: 56 or 64 kbps
- B1+B2 channels: 112 or 128 kbps

## Remote Operation

You can connect the Internet Advisor to other Internet Advisors or to PCs using standard Microsoft Windows remote operation software, such as pcANYWHERE 2.0.

## General Specifications

**Physical Specifications (J2300D)**

| | |
|---|---|
| Size: | 300 x 100 x 310 mm (12 x 4 x 12 in) |
| Weight: | 6 kg (14 lb); 7.2 kg (16.5 lb) with optional J3444A LAN undercradle |

**Power Requirements**

| | |
|---|---|
| External: | 100 to 120 and 200 to 240 V AC<br>50 to 60 Hz, 130 VA |

**Temperature**

| | |
|---|---|
| Operating: | 5° to 40° C (41° F to 104° F) |
| Non-operating: | -25° to 60° (-13° to 140° F) |

**Humidity**

| | |
|---|---|
| Operating: | 20% to 80% |
| Non-operating: | 10% to 90% |

**Condensation**
Not allowed

**Altitude**
Operating to 4.5 km (15,000 ft)

**Regulatory Compliances**

| | |
|---|---|
| EMC: | European Union EMC Directive<br>IEC 801-2, ESD Susceptibility<br>IEC 801-3, Radiation Immunity<br>IEC 801-4, Electrical Fast Transient Immunity<br>CE marked<br>C-Tick marked |
| Safety: | CSA 22.2 No. 1010-1<br>UL 3111<br>IEC 1010-1<br>CE marked<br>CSA marked |



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## Related Literature

| | | |
|---|---|---|
| Internet Advisor ATM | Product Overview | 5968-1437E |
| Internet Advisor WAN | Product Overview | 5967-5566E |
| Internet Advisor | Brochure | 5968-6076E |
| Basic ATM Troubleshooting with the Internet Advisor | Application Note 1327 | 5968-5924E |
| Testing and Troubleshooting Medium and High Speed Frame Relay Networks | Application Note 1323 | 5968-5310E |
| ATM Quality of Service | White Paper | 5968-8556E |
| Dual Simultaneous Measurements | Application Note 1346 | 5980-0547E |

## Warranty

Full 3 year Warranty
For software – warranty 90 day replacement only

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**This Product is Y2K Compliant**

## Agilent Ordering Information

| | |
|---|---|
| **J2300D** | Internet Advisor mainframe |
| **J2900A** | High Speed ATM/WAN undercradle |
| **J2294C** | E1 plug-in module (balanced 120 Ohm DB-9 and RJ-45 connectors) |
| **J2296B** | E1 plug-in module (unbalanced 75 Ohm BNC connectors) |
| **J2298B** | T1 plug-in module (100 Ohm RJ-48C and WECO mini-Bantam connectors) |
| **J2299B** | T1 plug-in module (100 Ohm RJ-45 and WECO mini-Bantam connectors) |
| **J3766A** | ATM25 plug-in module (RJ-45 connectors) |
| **J3759B** | E3/DS3 plug-in module (unbalanced 75 Ohm BNC connectors) |
| **J2912B** | STM-1/OC-3c plug-in module (SC-PC optical connectors) |
| **J2913B** | UTP155 plug-in module (RJ-45 connectors) |
| **J2914A** | STM-1e plug-in module (unbalanced 75 Ohm BNC connectors)* |
| **J3763A** | 622Vu STM-4c/OC-12c ATM undercradle (requires also J3764A or J3765A) |
| **J3764A** | Mono-mode Optical Interface for J3763A (supports multi-mode with Tx attenuators) |
| **J3765A** | Multi-mode Optical Interface for J3763A (does not support mono-mode) |
| **J2904B** | ISDN Basic Rate plug-in module for S & T interfaces |
| **J2905B** | ISDN Basic Rate plug-in module for S, T & U interfaces |
| **J2908A** | DDS 4-wire plug-in module |
| **J3762B** | HSSI plug-in module (50 pin SCSI connectors) |
| **J2277A** | V.36/RS-449 to DB15 cable (for X.21) |
| **J2278A** | V.36/RS-449 to DB25 cable (for RS-530) |
| **J2928A** | Optical attenuator (10dB) |

* available with the software release of the Internet Advisor following release 11.3

### ATM Training

| | |
|---|---|
| J5400A | Interactive Multimedia CBT Family |
| Opt 700 | ATM Network Analysis and Troubleshooting |


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