Issue Number 6

# Advanced Network Testing

**The magazine for ANT-20 users – The standard test platform for PDH, SDH, SONET and ATM PVC/SVC networks**

## The First Shipped Portable 10 Gbit/s Test Solution Worldwide:

# ANT 10Gig

### Strong market and technology trends

To meet the tremendous demand for bandwidth during recent years, two technologies have become established. One is a faster time-division multiplexing (TDM) of synchronous channels to achieve higher bit rates, the other is optical multiplexing of a large number of synchronous channels to be carried by a single fiber (DWDM). The basic idea behind both methods is to make the best possible use of available fiber capacity.

### There is a demand for testing

Can you imagine what a transport capacity of 10 Gbit/s means? To give you an example: The movie "Titanic" which lasts over three hours can be transmitted in only one second using an STM-64 or OC-192 line. Incredible, isn't it?
On the other hand, this little example illustrates the need for test solutions. Distortion or disruption of such a data highway would affect many more channels and more transmission capacity than ever before. Degraded transmission quality or signal unavailability may cause a loss of image and money that could have been avoided using modern communication test tools.

### n x 64 kbit/s to 10 Gbit/s testing with a portable instrument

The ANT 10Gig handles STM-64/OC-192 and provides unique portability in the world of 10 Gbit/s testing. The instrument allows you to test all levels from n × 64 kbit/s to 10 Gbit/s.

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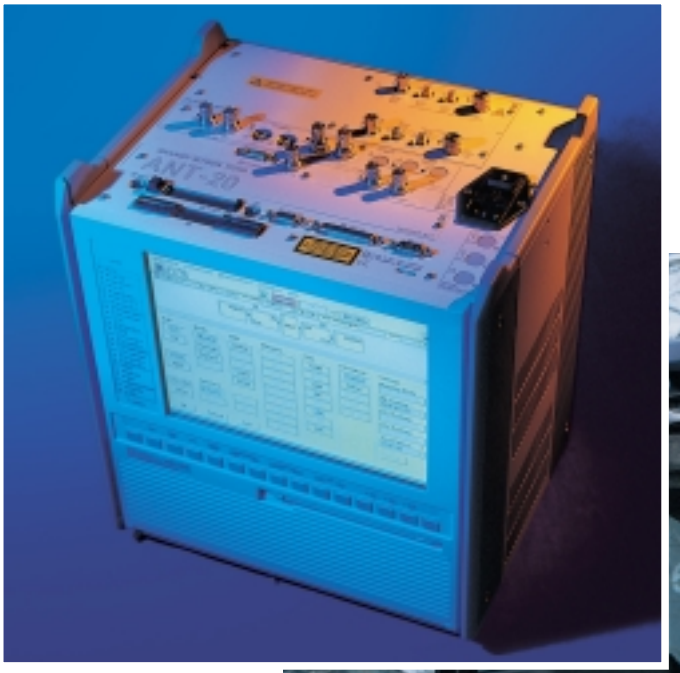



**The Advanced Network Tester 10Gig is a special version of the tried and trusted ANT-20E. The 10 Gbit/s module occupies three slots.**

**Configuration**

The ANT 10Gig is shipped as an SDH or SONET version with the following configuration:

- Mainframe with color screen, touchscreen and 32 MB RAM
- STM-64/OC-192 module
- All mappings for either the SDH or SONET version, including the concatenated mappings up to STM-16c/OC-48c
- Ring testing capabilities (automatic protection switching, overhead byte capture)

The ANT 10Gig can be expanded with additional optical interfaces and ATM-SVC/PVC functions, for example.

**The ANT 10Gig is the first portable 10 Gbit/s test solution.**

**Where to use ANT 10Gig?**

- Type approval for STM-64/OC-192 network elements in labs
- Saving measurement time using test sequencing software
- Verifying acceptable transmission quality to telecom operators
- Monitoring 10 Gbit/s transport backbones to guarantee high availability
- Fixing problems quickly during operation.

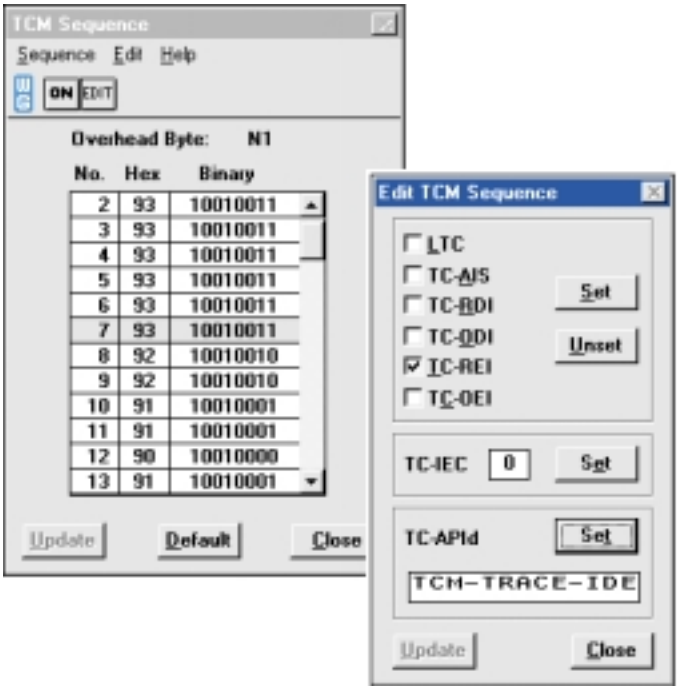
The ANT 10Gig has been shipping since November 1999.

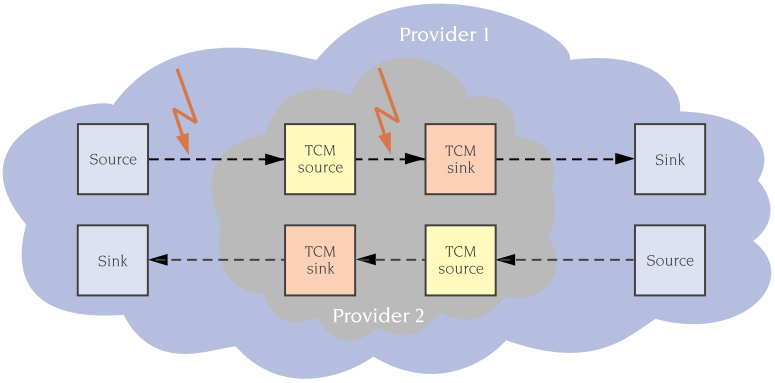
*Werner Habisreitinger*

**ANT-20 Now with TCM Generator:**

# Check for Proper TCM Behavior

In *Advanced Network Testing*, issue no. 4, tandem connection monitoring (TCM) and the TCM analysis functions were presented, which are part of the ANT-20's "Extended Overhead Analysis" option (3035/90.15, Software Version 6.6). The new software version 7.0 builds upon this to now include the capability to generate TCM events. ANT-20 thus offers all of the generation and analysis tools needed to verify proper TCM behavior.




The TCM protocol is transported in the N1/N2 bytes of the TOH; 76 frames form a TCM multiframe. Each byte in the TCM multiframe can be edited using the ANT-20 to generate specific stress patterns. In addition, major events such as alarms, errors and the TCM trace can be simulated:

LTC: Loss of Tandem Connection
ODI: Outgoing Defect Indication (response to received AIS, TIM)
OEI: Outgoing Error Indication (response to received BIP-n violations)
IEC: Incoming Error Count (B3 errors detected at entrance of TC sub-net)
APId: Access Point Identifier (source of Tandem Connection)

Without these functions, it would be necessary to "program" and execute a 76-frame N1/N2 byte sequence. In-depth protocol expertise would be required, not to mention considerable time investment. With the ANT-20, however, you will find it very convenient to make tests within a TCM environment.
For two years now, the ANT-20 has been the only SDH analyzer to offer TCM test functions.

*Chrysiida Angelopoulou*

| | Necessary option | Necessary basic software |
|---|---|---|
| TCM analyzer | Extended Overhead Analysis (3035/90.15) | Software version 6.6 or higher |
| TCM generator | Extended Overhead Analysis (3035/90.15) | Software version 7.0 or higher |

**Coming April 2000:**

# Software Version 7.1 – What's New?

The latest software version for the ANT-20 will be released in April 2000 and supports the following functions:

**STM-64/OC-192 and mapping of STM16c/OC-48c in STM-64/OC-192**

With the multiplex function STM-64/OC-192 for 10Gbit/s, we are expanding the main applications and functions of the ANT-20 for higher bit rate signals, taking you one step further towards the data highways of tomorrow.

**Performance analysis as per ITU-T Rec. M.2101**

This Recommendation is very close to M.2100 in terms of purpose and format, but it deals exclusively with SDH systems.

**Maximum tolerable wander (MTW)**

With software version 7.1, the ANT-20 automatically determines whether the wander amplitudes specified by ITU are tolerated by the device under test.

*Chrysiida Angelopoulou*

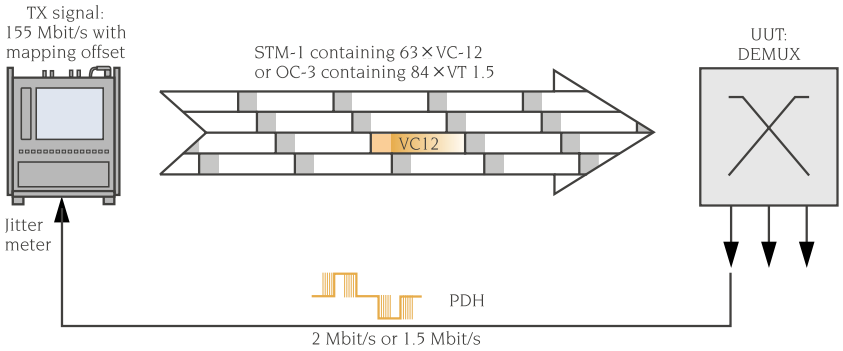
**Now with Support for STM-64/OC-192 Signal Structures and Jitter Measurement as per O.172/GR-253:**

# ANT-20 CATS Test Sequencer, Version 4.0

Version 4.0 of the ANT-20 CATS Test Sequencer has been available since early 2000. It includes the following new functions:

- Supports new hardware for STM-64/OC-192 signal structures

- Supports new O.172 jitter hardware: All of the CATS jitter test cases now function with either the ANT-20's old O.171 jitter hardware or the new O.172 jitter hardware (selectable). The new test functions are RMS Jitter and Selective JTF (jitter transfer function).




**The ANT-20 CATS Test Sequencer can offset a tributary (in this example, one of the 63 VC-12 contained in the STM-1) and then measure the resulting mapping jitter.**

- Functions for determining the mapping jitter, pointer jitter and combined jitter as per O.172 and GR-253: A new CATS test case automatically determines the maximum mapping jitter. To do this, the ANT-20 generates an STM-1 or OC-3 signal and offsets the bit rate of an E1 or DS1 tributary it contains (see Fig.). At the output of the device under test, the ANT-20 measures the resulting mapping jitter in the demultiplexed PDH signal as a function of the mapping offset. The maximum jitter value is stored. The subsequent measurements are performed with the offset setting which caused the maximum mapping jitter.
Now, additional pointer sequences are generated. On the E1 or DS1 end, the "combined jitter" is measured, i.e. the jitter resulting from mapping and pointer movements.
A fully automatic CATS test sequence is available for these complex measurements. It can be easily expanded for other bit rates and customer-modified to meet special requirements.

- Significant improvements to the CATS report format and the test documentation:

CATS test sequences can now be written as ASCII or HTML files, and the test report is also available as an HTML file. The report file is written while still measuring, and you can scroll through it during the measurement. If necessary, existing CATS sequences can be edited as an ASCII file and then converted.

*Walter Besse*

**ATM Module 3035/90.70, "ATM Traffic Analyzer" Application:**

# How Do You Interpret the Peak Cell Rate Display?

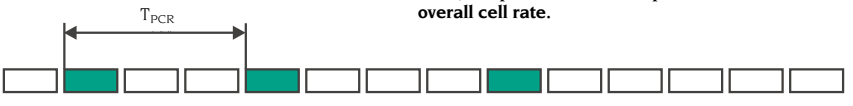
The ANT-20's ATM Traffic Analyzer displays three values for an ATM connection: the test channel load and the total load (both in terms of average utilization) and the peak cell rate (PCR) (peak utilization). The minimum inter-arrival time TPCR between two cells of a connection is a further measure of the peak utilization. There is a reciprocal relationship between the PCR and $T_{PCR}$:

$PCR = 1/T_{PCR}$

This relationship is best illustrated with a graph. In our example, the two cells on the ATM connection being monitored (green) are three cells apart, i.e. two "outside" cells come between them. TPCR is thus equal to the transmission time of three cells.

Since the spacing in time of cells in a connection can vary only in integral multiples of the cell length, we also obtain fixed values for the PCR (the reciprocal), i.e. a half, a third, a fourth, etc. of the

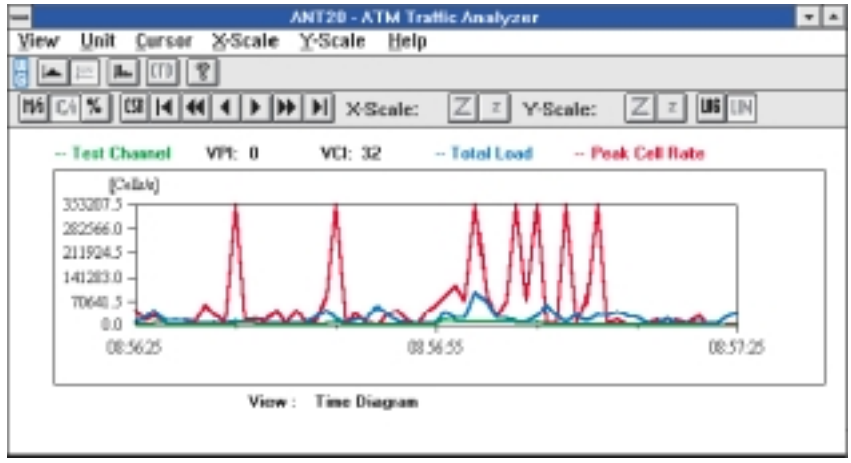
**Green: Cells in the ATM connection under test.
White: "Outside" cells.
Here, the peak cell rate is equal to one third of the overall cell rate.**



overall cell rate. The PCR can be indicated in cells/s, as a percentage of the overall cell rate, or as the transmission capacity in Mbit/s.
Example: An ATM connection via a C4 container (used in the SDH network) has an overall transmission capacity of 149.76 Mbit/s. The following PCR values are possible:

Cells with no spacing PCR = 149.76 Mbit/s
with 1 cell spacing PCR = 74.88 Mbit/s
with 2 cell spacing PCR = 49.92 Mbit/s
with 3 cell spacing PCR = 37.44 Mbit/s
etc.

The ANT-20 will display the PCR for a selected ATM connection. The instrument measures the shortest cell spacing within 100 ms. However, the largest value within a second is displayed in the timing chart. Despite this simplification, it is still possible to make a reasonable assessment of the burstiness of the ATM connection under test. Our example:




Although the test channel load (green curve) is very low, the PCR (red curve) sometimes jumps to 100% of the overall cell rate. This is an indication of bursty ATM traffic, and could look as follows:

**Top: The display of the ANT-20 ATM Traffic Analyzer: Test Channel Load (green), Total Load (blue) and Peak Cell Rate (red).**

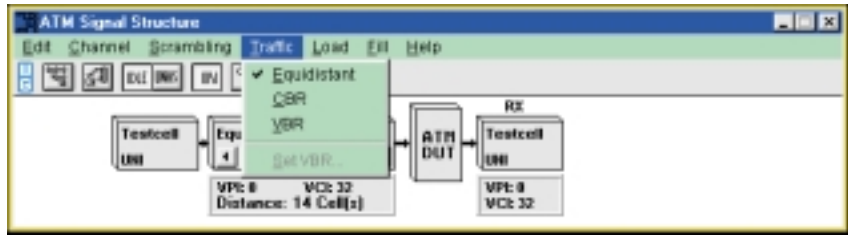
**Bottom: A cell burst causes the PCR values to jump.**

### ATM Module 3035/90.70, "ATM Signal Structure" Application:

## What's the Difference Between "CBR" and "Equidistant"?

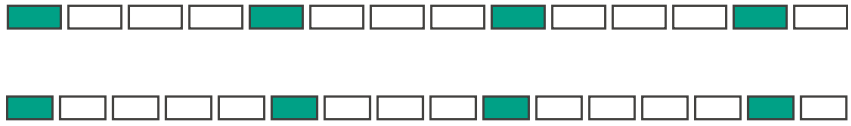
In the "Equidistant" ATM signal structure setting, the ANT-20 generates ATM test channels with a constant cell spacing over the entire traffic profile. If we use the cell rate or the bit rate as the setting parameter, then we can have integral fractions of the overall rate (half, third, etc.). We can also enter the distance of the cells (integral values).
Of course, as with all of the other traffic models, you can modify this parameter in real time, using the slider control in the virtual instrument. This is one benefit of the ANT-20 you won't find in every ATM tester.
In the real world of ATM transmission, the cell spacing on a connection is not uniform, nor does it have to be so for test purposes. In addition, a finer setting of the test bit rate is often desirable. This is why the ANT-20 offers the CBR (constant bit rate) traffic profile, which lets you finely set any bit rate you want so that the average value of the PCR equals the set bit rate. This traffic profile does not meet the tough requirement of a constant test cell spacing.
To sum it up, we can say that "equidistant" traffic is always "CBR" traffic, while "CBR" traffic is "Equidistant" only in exceptional cases.

*Werner Habisreitinger*

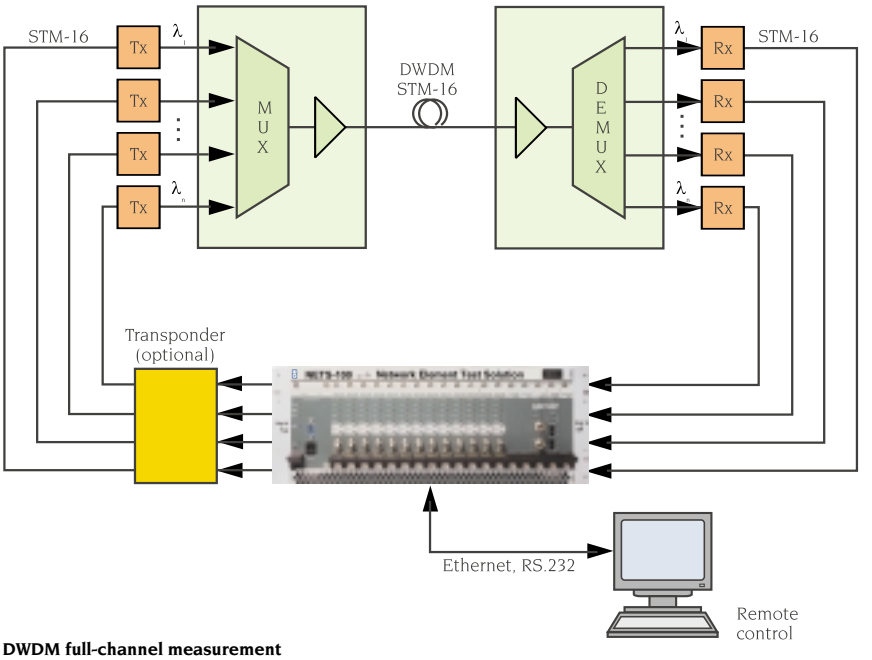



**The choices: Variable Bit Rate (VBR), Constant Bit Rate (CBR) and Equidistant.**

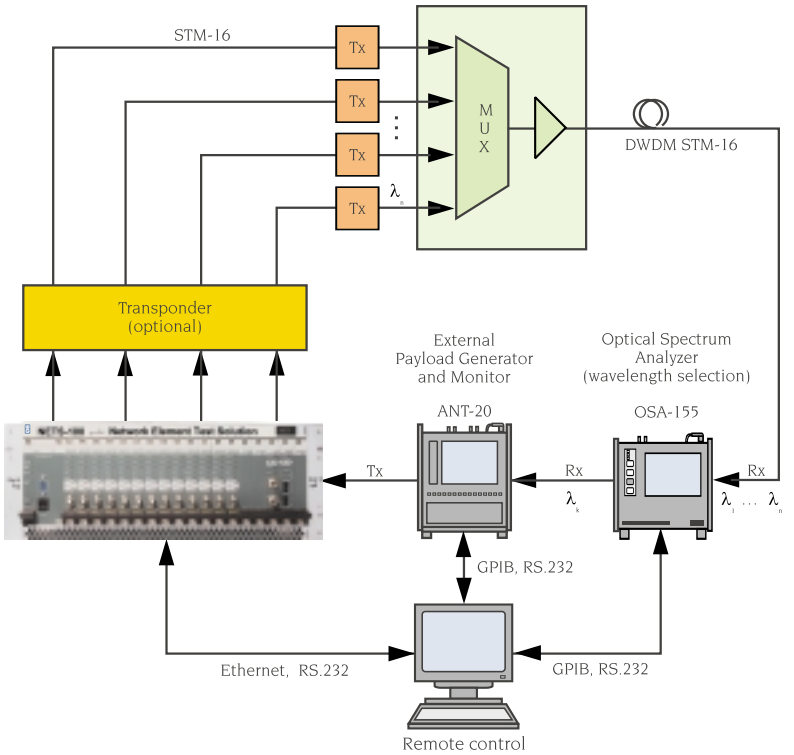
**Equidistant (bottom) generates exactly uniform cell spacings, while with CBR (very bottom), the average spacing is the same.**



# DWDM Application: Structure, Method, Benefits




**DWDM full-channel measurement**




**DWDM half-channel measurement**

In our last issue, we presented the NETS-100, a full-channel ADM tester. Now we'll take a look at DWDM MUX/DEMUX test applications.

With one NETS-100 mainframe, full-channel tests are possible on up to eight STM-16 channels. To handle more than eight channels, a number of mainframes can be operated in tandem. Testing is conducted in parallel, since all anomaly insertion and anomaly monitoring is performed for each STM-16 channel separately and simultaneously. This is important because production and verification tests of DWDM MUX/DEMUX equipment must be performed under worst case conditions, i.e. full load on all interfaces.

This is where WWG beats competing solutions. Most competitor's instruments can only perform these tests on one channel at a time, so several instruments are needed in a system to perform parallel testing. Also, these instruments often have too many features for such simple applications, which drives the total cost very high. This makes a multiple/parallel instrument approach impractical in terms of size and affordability.

The combination of the NETS-100/ANT-20/OSA-155 is very effective for half-channel measurements. NETS-100 works on the transmitting end as a regenerator; the ANT-20 generates the payload. On the receiving end, the OSA-155 DWDM System Analyzer measures the optical parameters and selects one wavelength for further analysis with the ANT-20. This half-channel test setup is possible either in addition to or as an alternative to the full-channel test described above.

*Hans-Werner Schaal*

## Create Impressive Printouts with

# The ANT-20's "Beauty Print" Feature

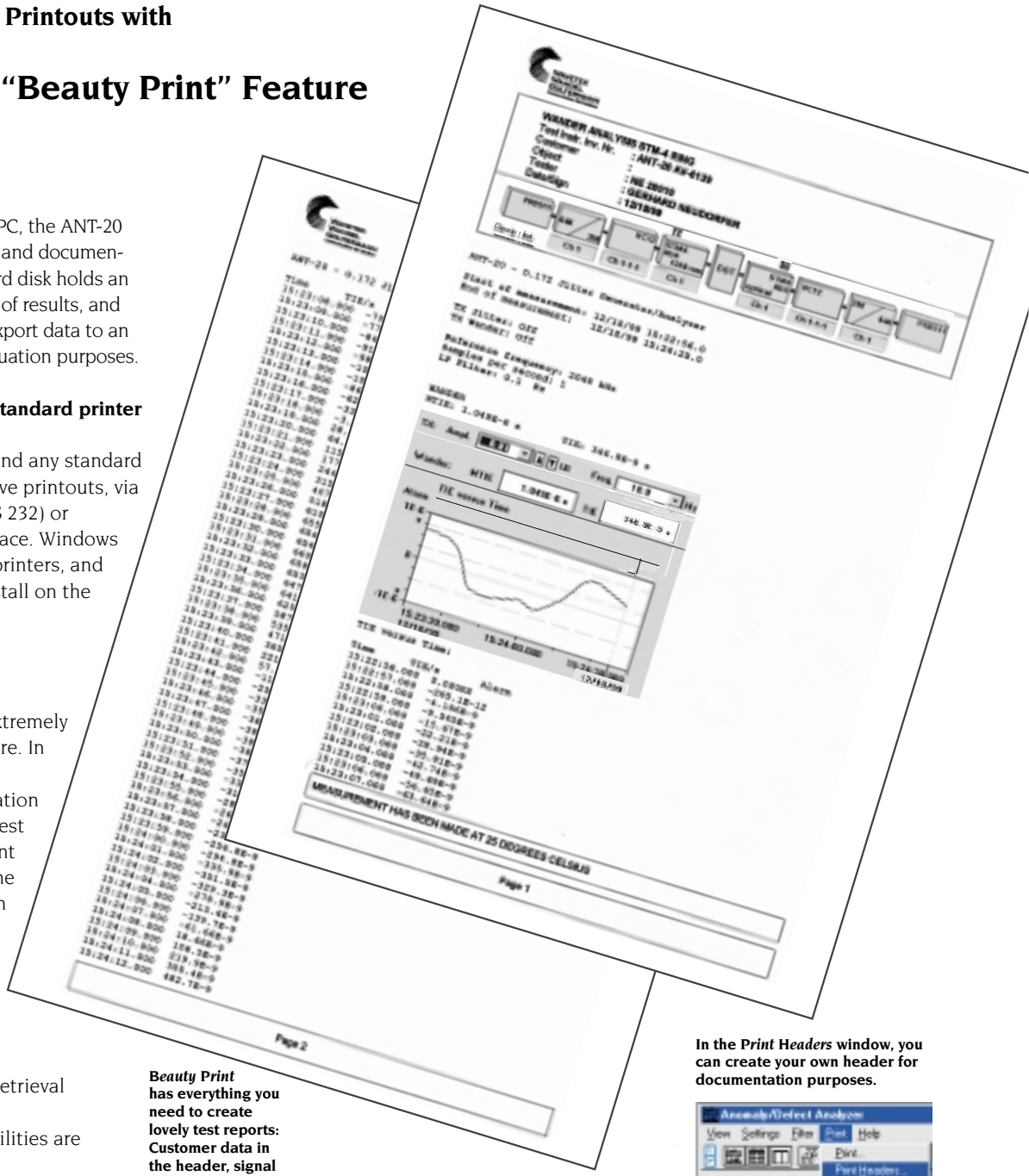
With its built-in Windows PC, the ANT-20 has very extensive storage and documentation capabilities: The hard disk holds an almost unlimited quantity of results, and you can use diskettes to export data to an external computer for evaluation purposes.

**ANT-20 works with any standard printer**

You can use the ANT-20 and any standard printer to create impressive printouts, via either the serial (V.24 / RS 232) or parallel (Centronix) interface. Windows supports many different printers, and the drivers are easy to install on the ANT-20.

**"Beauty Print"**

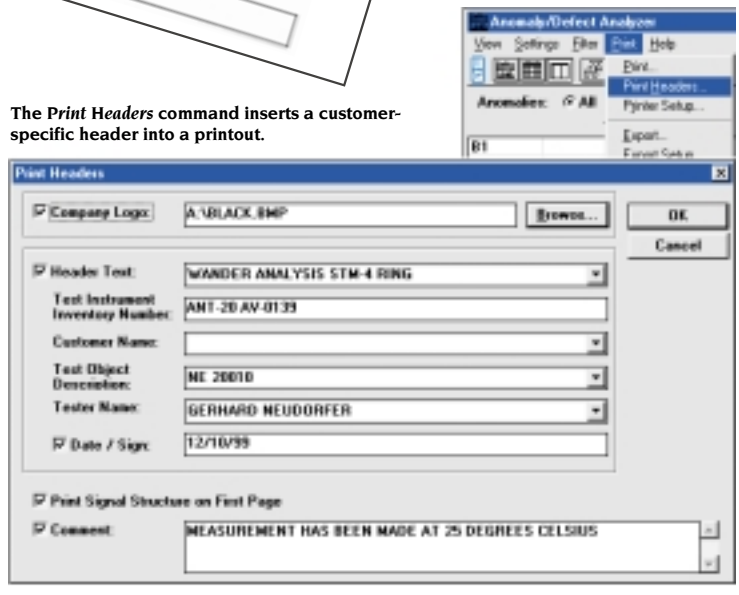
This is how we call this extremely convenient printout feature. In the header, you can enter customer-specific information such as the name of the test person, the test equipment and the company logo. The signal structure setting on the ANT-20 can be included, along with the test conditions and all results (numerical or graphical format). This is your basis for straightforward documentation, retrieval and archival.
The following print capabilities are supported:
*Numerical*: Anomalies, defects, performance, pointers, jitter F-MTJ, jitter vs. time, wander TIE, ATM traffic analyzer.
*Graphical*: Jitter MTJ, JTF, jitter vs. time, wander TIE.




**Beauty Print has everything you need to create lovely test reports: Customer data in the header, signal structure, measurement settings and, of course, your results in graphical or numerical format.**

**The *Print Headers* command inserts a customer-specific header into a printout.**

**In the *Print Headers* window, you can create your own header for documentation purposes.**



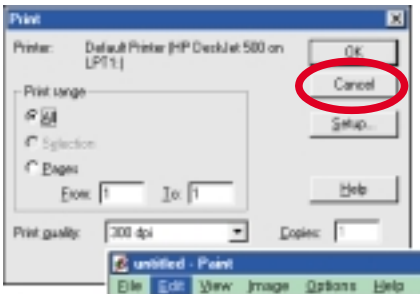

**Print setup made easy**

*Print/Printer Setup* is used to select and configure the printer. Check for the right paper type (A4 or Letter) since some printers have a problem with this.
Use *Print/Print Headers* to open the window for entering customer-specific information to appear in the printout header/footer.
Once the measurement is complete, use *Print* to generate the report.

**Saving and printing intermediate results**

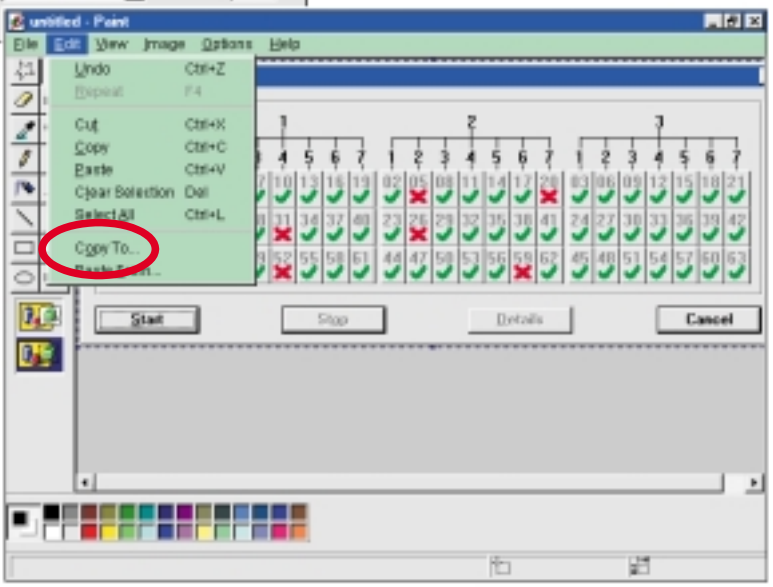
You can also save intermediate results, either during or after the measurement. There are two possibilities:
1) Storage of the entire current screen content: To do this, just press *Print Screen* ("Prt Sc" key). This is a way of getting different results on one page.
2) Storage of the content of the currently active window: Just press *Alt Print Screen* ("Alt" + "Prt Sc" keys). The actual transfer to the buffer takes place by pressing *Cancel* in the *Print* window as it opens.
An ongoing measurement is not interrupted, i.e. the content of the buffer represents a snapshot of the results.
You can use the Microsoft®? *Paint* program to fetch the results from the buffer and print them. *Paint* is found under *Start/Programs/Accessories*. Or, using *Copy To ...* you can store your results as a bitmap (.bmp) to hard disk or floppy.

*Werner Habisreitinger*




**Press *Cancel* to copy the screen contents to the buffer.**

**Use *Copy To ...* to save a result window in bitmap (.bmp) format.**

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