

Signals Analysis System

3587

HP



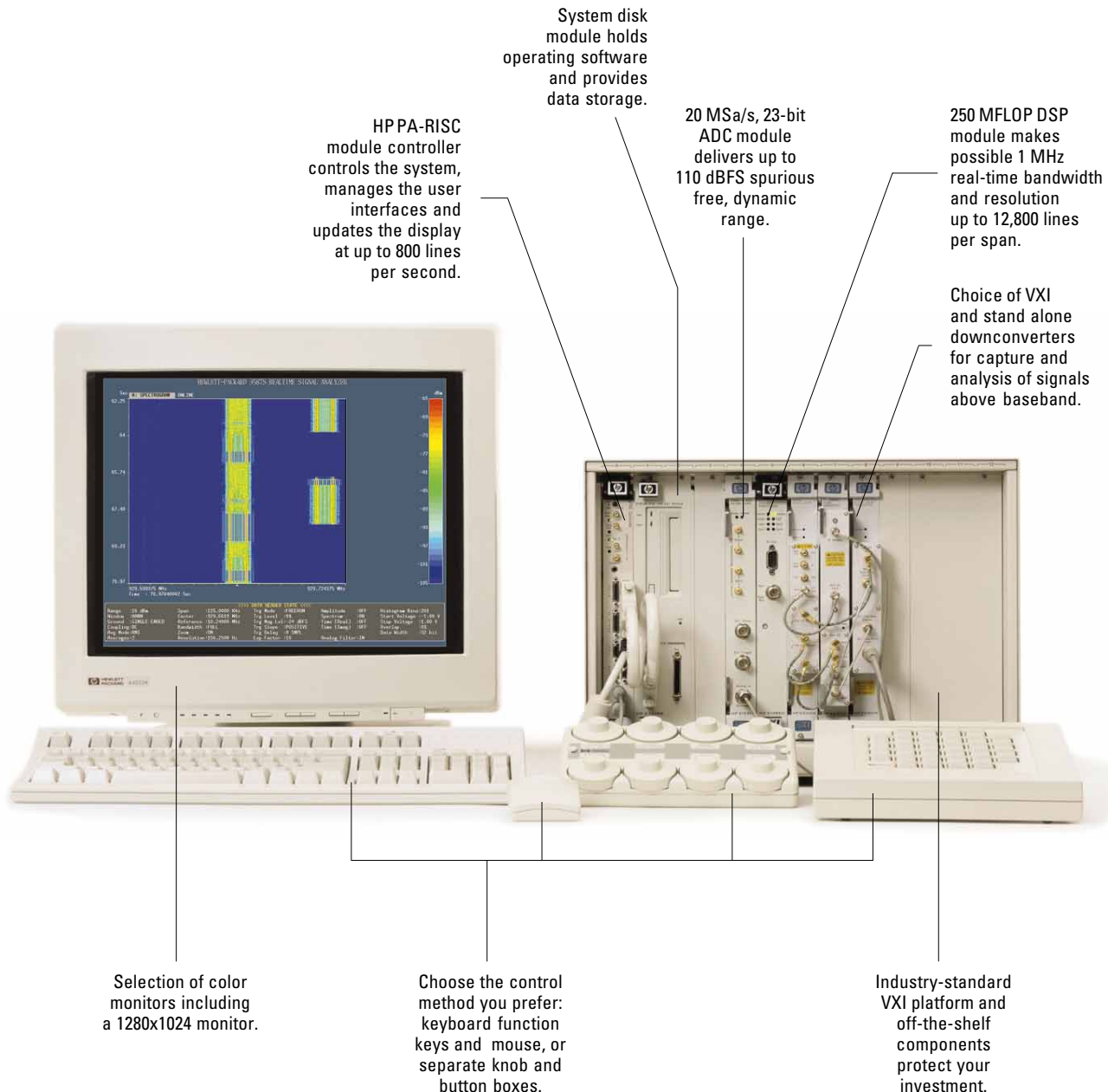
Flexibility
and speed
for signal
characterization

The HP 3587 signal analysis system delivers the performance and processing power you need

- 8 MHz input bandwidth
- 1 MHz real-time bandwidth
- Up to 110 dBFS dynamic range
- Frequency, time and amplitude analysis
- High speed displays

When your signal analysis and characterization needs have pushed the limits of traditional instrumentation, it's time to consider a new approach. The HP 3587 signal analysis system combines wide dynamic range digitizing, high-power signal processing, versatile high-speed displays, and signal capture tools to find and study signal characteristics that may well have escaped detection in the past.

Successful signal analysis requires more than just measurement performance however. You need signal processing tools and a wide selection of display types and presentation formats to characterize a signal fully. The HP 3587 provides all these in a commercial-off-the-shelf package.



Measurement architecture: delivering clean signals quickly

The HP 3587 is built around VXI, the IEEE modular instrument standard. This provides the power and flexibility to combine high-performance hardware modules with specialized signal acquisition and analysis software.

Start with a high-resolution ADC module

The HP 3587 achieves up to 110 dBFS of spur-free dynamic range through a combination of innovative ADC hardware and an exclusive distortion-correction algorithm that corrects every sample as it is taken.

The ADC's noise performance keeps the signal clean, with sensitivity on its lowest input range down to -158 dBm/Hz (16 dB noise figure).

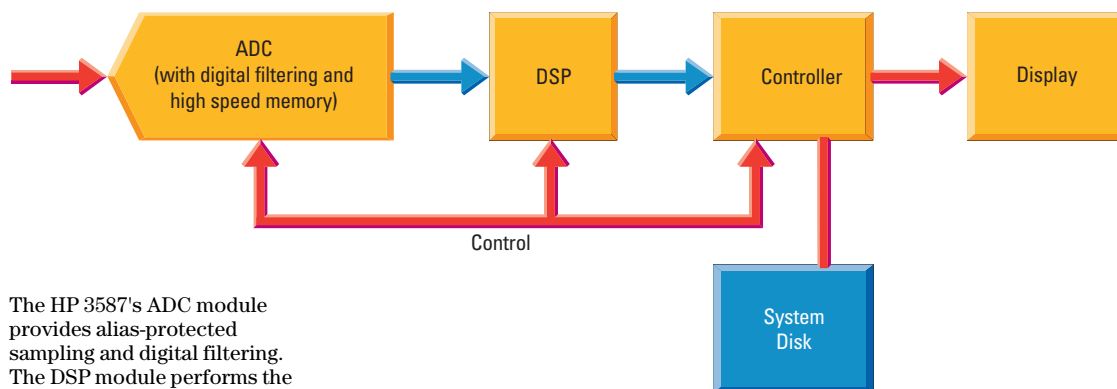
Use the digital filtering included in the ADC to reduce the measurement span so you can focus on signals-of-interest. Select span widths from 8 MHz to 0.5 Hz, in octave steps. The digital LO included with the filtering lets you tune the center frequency of the selected span anywhere in the 8 MHz input range of the digitizer with 20 μ Hz resolution. Both I and Q data are made available for further signal processing.

Use the high speed memory that is part of the ADC module for full span real time capture of signals. With the 64 MByte memory option (option ANE) installed in the ADC you can capture signals with a 8 MHz real-time rate for approximately 1.6 seconds (maximum, 16 bits per sample).

Process those samples with a fast DSP module

The key to the HP 3587's measurement power is digital signal-processing (DSP) technology. To maximize speed, the system uses the HP E1485C VXI DSP module and its five 32-bit Motorola 96002

HP 3587 block diagram



The HP 3587's ADC module provides alias-protected sampling and digital filtering. The DSP module performs the high-speed FFT calculations and averaging, then passes the resulting data to the system controller module for display.

floating-point DSP's. With a combined 250 MFLOPS of raw computing power, the HP E1485C can compute an 800-line complex FFT in 800 μ sec. This DSP power gives the HP 3587 a 1 MHz real-time bandwidth.

Choose the FFT resolution that meets your needs

To better isolate signals and reduce displayed noise, set the FFT algorithm to provide 12,801 lines of resolution. For maximum speed set the FFT to provide only 51 lines. The HP 3587 FFT resolution ranges from 51 lines to 12,801 lines in octave steps. And, choose from a variety of FFT windowing functions, including uniform, Hanning, Gaussian, Gausstop, flat top, and Blackman.

Use the right downconverter for the job

The HP 3587 adapts to the downconverter of your choice and provides seamless, integrated operation. Displays are automatically translated to RF as you manually tune the downconverter from the HP 3587 user interface.

Choose one of the three downconverters the HP 3587 is already programmed to control: the WJC9119L/R (0.1 to 32 MHz) high dynamic range HF VXI tuner, the HP E6500 (20-3000 MHz) VHF/UHF VXI tuner, or the HP 89431A (2-2650 MHz) tuner. Or, make simple edits in a parameter file (part of opt AGG) to control your own downconverter. RS-232, VXI and HP-IB ports provide the interface to your downconverter.

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Control it all with the high-performance controller

The nucleus of the HP 3587 is its embedded controller. This full-featured UNIX[®]-based module includes SCSI and LAN interfaces, expandable RAM, and graphics. It controls the HP 3587, manages the user interface and provides high-speed displays, with an update rate of up to 800 lines/second.



In addition to a keyboard and mouse, the system controller provides two other user interface devices. A button box and a knob box let you run the system in real time while you're watching measurement results on the display. You get the computational power of a workstation with the feel of a conventional instrument.

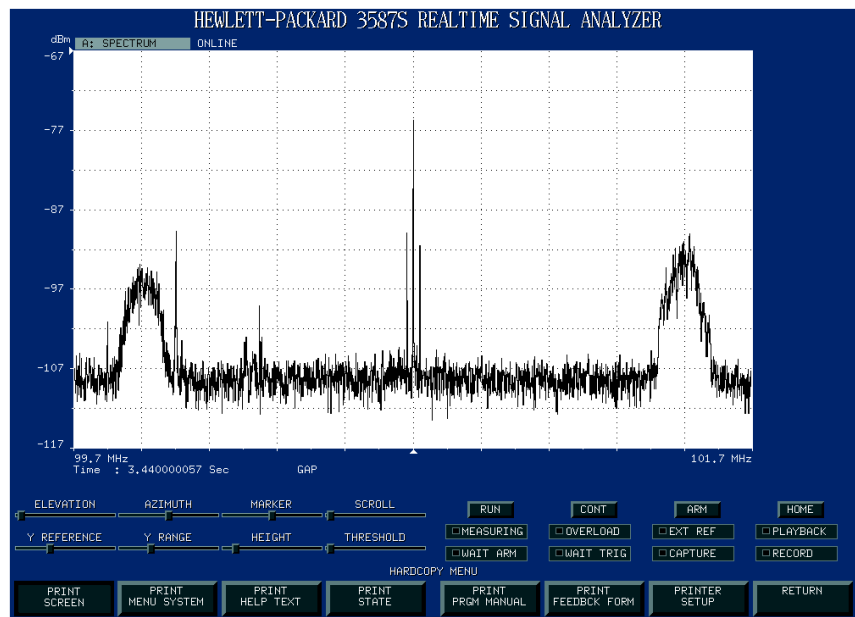


Measurement domain: frequency, time and amplitude

Frequency domain

Use frequency-domain measurements to find signal relationships in frequency and power. View weak signals and high power signals in the same display. See and quantify elements of signal structure such as turn-on and turn-off transients and transmitter drift that are difficult or impossible to isolate any other way.

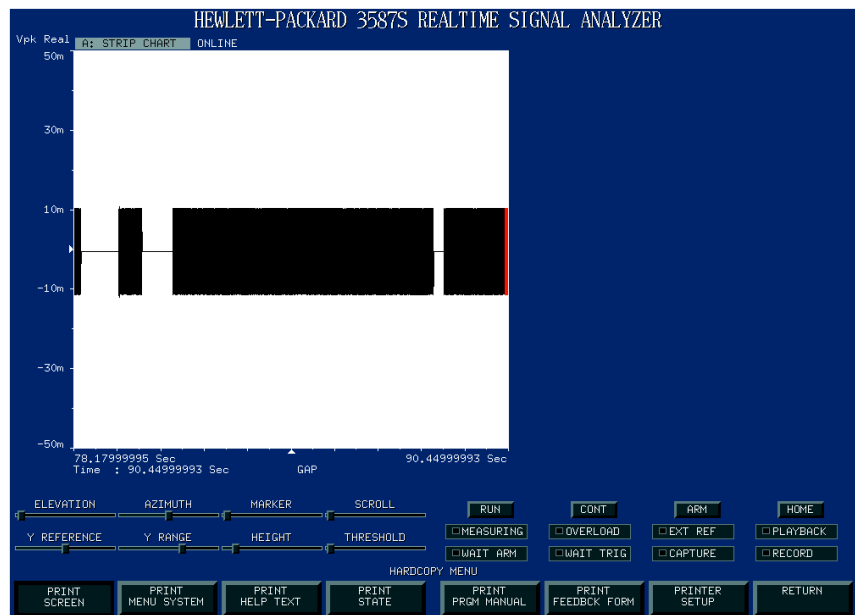
The frequency domain can show both weak and strong signals on a single trace.



Time domain

As powerful as the frequency domain is, it isn't the only measurement choice. In some cases, viewing a signal in the time domain yields insights that aren't apparent in the frequency domain. Signal rise time, fall time, drop-outs, and associated characteristics are more easily seen in the time domain.

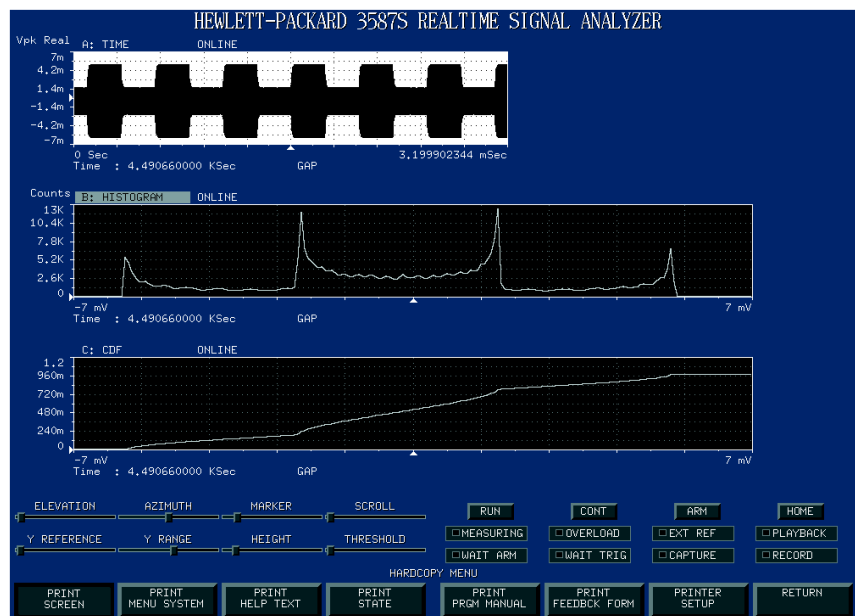
Strip chart display of time domain data.



Amplitude domain

In other cases, the amplitude domain is your best choice. The histogram, a common statistical measurement in this domain, plots amplitude along the X-axis and frequency of occurrence along the Y-axis. The HP 3587 also computes the probability density function (PDF), which indicates the probability that a given amplitude level occurred, and the cumulative density function (CDF), which indicates the probability that any level equal to or less than a given level occurred. These three amplitude measurements give you an extra set of tools for analyzing and deconstructing a signal.

This amplitude domain display shows the histogram (middle), and CDF (bottom), of an amplitude modulated sinewave.



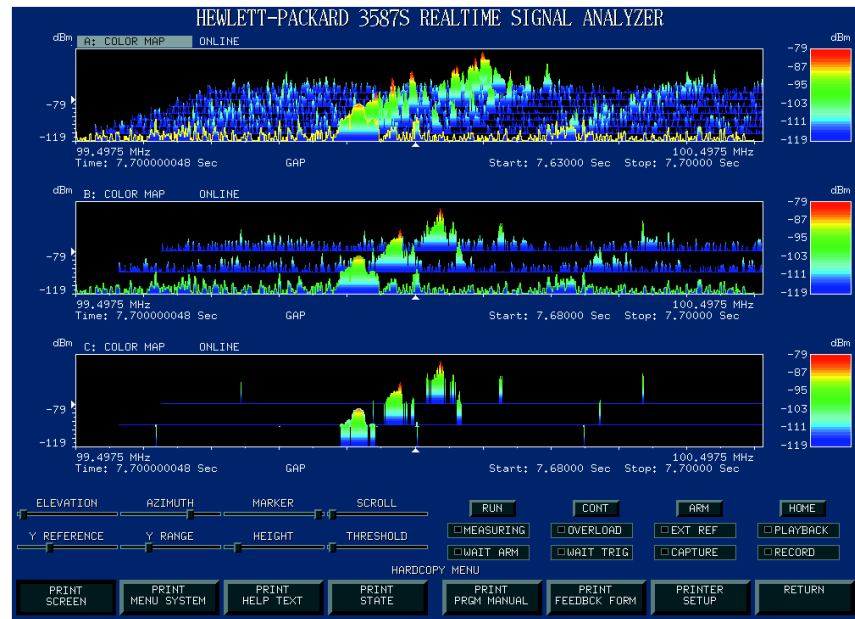
Display choices: more tools for effective analysis

The HP 3587 goes far beyond the usual set of display features to offer presentation flexibility, user-selectable color schemes, and a number of unique display formats to help find and define signal structure. The displays shown here give you an idea of the wide range of tools the HP 3587 offers.

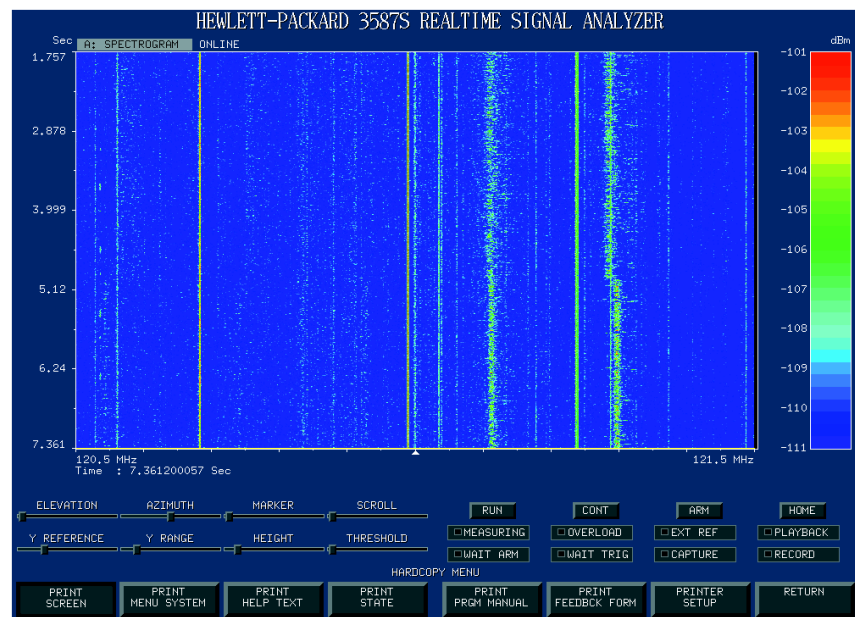
Signal analysts have come to rely on a particular set of display types, and the HP 3587 provides these in easy to use, flexible formats. Choose a signal spectrum, fill spectrum, time, or histogram trace, or stack up to three traces on the display at once. Pick the strip chart display and compress from 8 to 1024 time records into a signal trace, showing how a signal develops over time.

Spectral map and spectrogram give you three-dimensional display options. You can change the viewing angle (azimuth), distance between traces (elevation), and trace height of the map – making the changes while the display is in progress to maximize its usefulness. Set a noise threshold to mask low-amplitude noise and signals or choose the wireframe mode that makes its easier to see spectrum contours.

The color map display indicates amplitude levels with both the normal spatial variations used in a spectral display and color variations. This combination of spectral map and spectrogram makes it much easier to see small details and subtle changes in the signal.



The color spectral map stacks multiple traces one on top of the other to show signal history with power shown as trace contours and color coding. Adjust azimuth to control apparent viewing angle (top). Adjust elevation to change vertical trace spacing (middle). Adjust threshold to emphasize signal peaks (bottom).

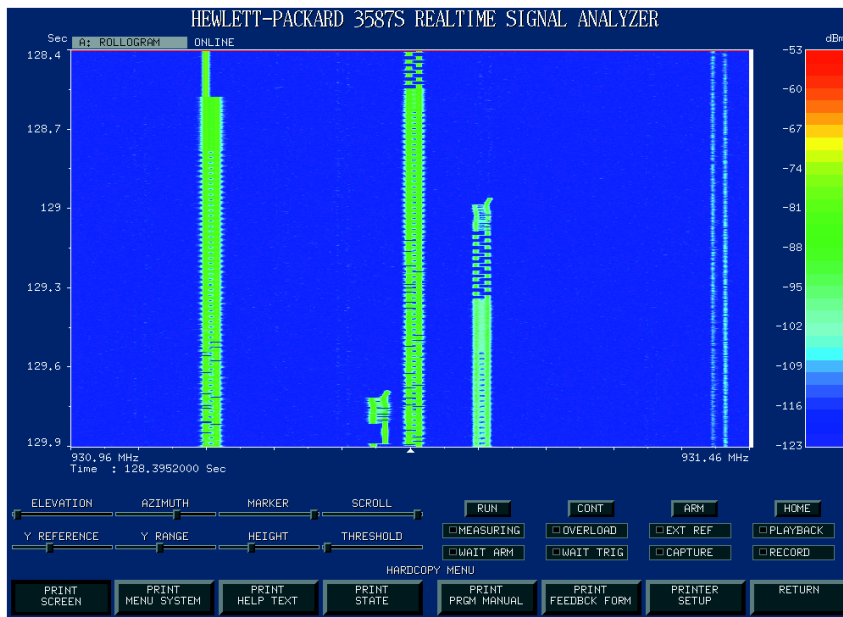
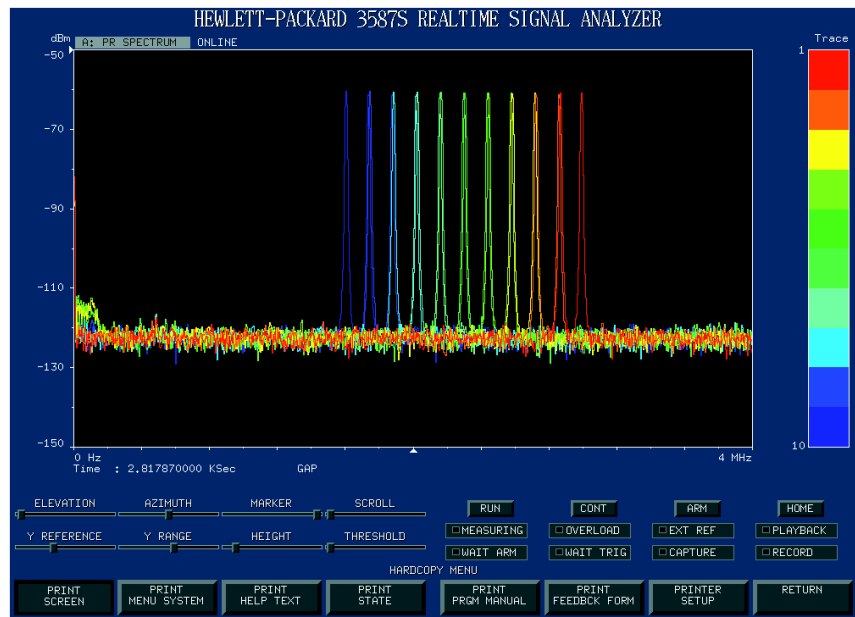


Spectrogram stacks traces to show frequency (X axis), time (Y axis) and amplitude (color) on one display. This high speed format updates as rapidly as 800 traces/sec. A display buffer lets you scroll back through more than 32,000 traces to review previous measurements.

Innovative displays: more choices for advanced signal intelligence

The HP 3587 goes beyond the traditional display choices, providing an array of new tools to help you analyze even the toughest signals.

The digital persistence mode is a new twist on the old idea of a storage oscilloscope. You can watch a signal fade away (or fade from one color to another) as new traces are acquired, giving you a clear picture of how a signal changes with time.



The rollogram display is a high-speed version of a spectrogram. Rather than adding new traces from the bottom of the screen (and redrawing all traces), the rollogram starts at the top of the screen and draws each new trace below the last. You get the same results as a spectrogram, only faster.

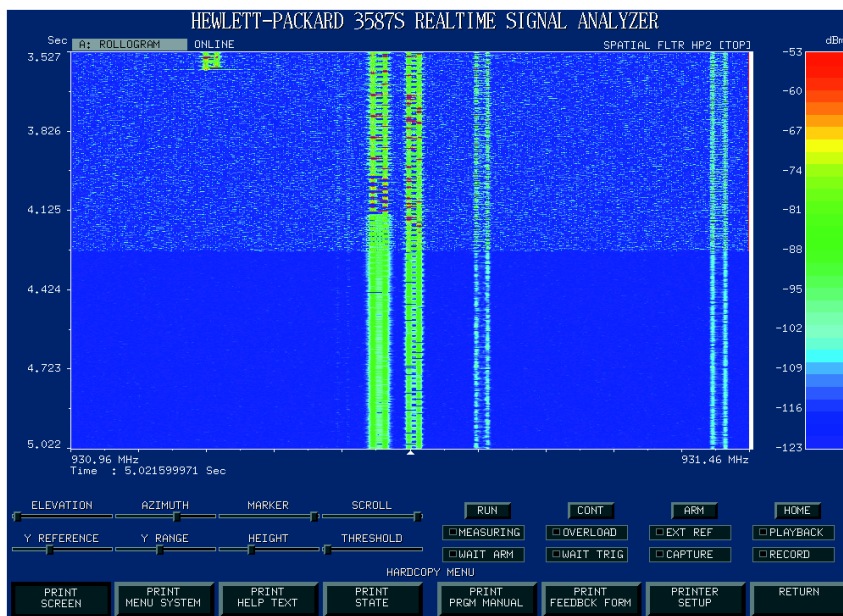


Image processing mathematically enhances part, or all, of a spectrogram display to help you uncover patterns and signal characteristics that might not be obvious in regular display traces. Choose low-pass filters to reduce high-frequency visual noise, high-pass filters to increase the image sharpness, and Laplace transforms to enhance edges or transition areas in the signal, making areas of significant amplitude change easier to see.

Display control and signal capture

Use markers for detailed analysis

Markers help you analyze important details, from reading out numeric values of specific points on a trace to computing differences between two points on a trace or between points on two different traces.

- The peak search feature moves the marker to the highest point on the trace.
- The power marker computes the power in a specified band.
- The spectrogram marker shows you time and frequency differences between any two points in the entire spectrogram.

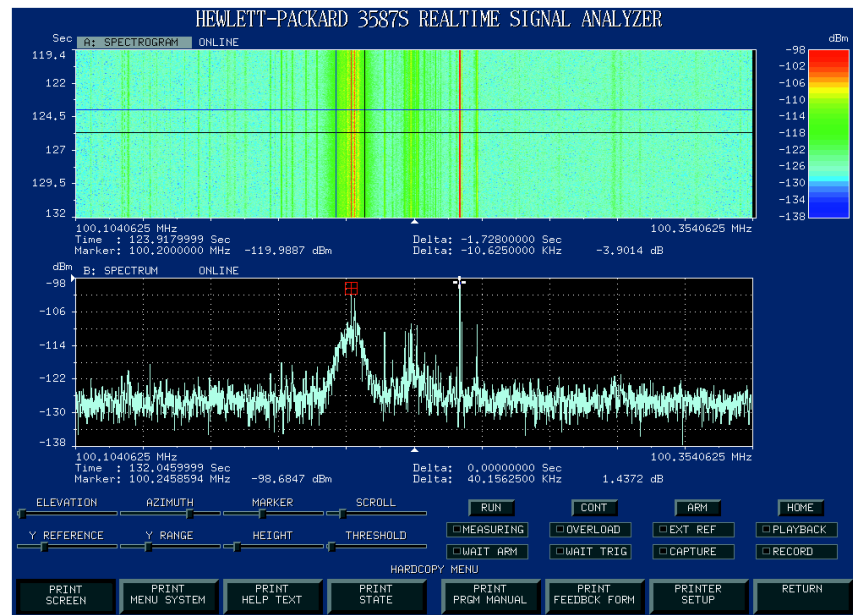
With option AGG you can also program your own marker function to perform specialized or automated tasks.

Capture signals to find critical events

Select one of several methods to best capture data for your application:

Display record and playback lets you stream traces from the display to the system disk until you've caught the event you're looking for; then simply stop the recording process. The amount of trace data you can record is limited only by the available system disk space – typically >1 GByte.

Raw signal sample capture and playback is flexible and fast because there's no delay for signal processing or display manipulation. The signal is digitized at full bandwidth and stored directly to the ADC's buffer memory, up to 64 MBytes with the HP E1437A. You can then process the data immediately or save it to disk. Signal capture is an invaluable feature if you need to capture signals at full ADC input bandwidth.



**Use markers to
display and
compare the
values of specific
points or bands
in trace, map and
spectrogram.**

Use option ATR wide band signal recording

See things you can't see when using analog recording techniques. With Option ATR and eight HP E1562 fast data disk modules, the HP 3587 records signals with up to 110 dBfs spurious-free dynamic range. That's more dynamic range than any analog tape recording. It's also state-of-the-art for digital recording.

Digital recording

With eight fast HP E1562 data disk VXI modules, Option ATR accesses 64 GBytes of hard disk storage, providing 52 minutes of 4 MHz bandwidth signal capture time.

If you have signals that come and go unpredictably with long periods of "dead air" between, use Option ATR's circular buffer mode to capture them. In this mode, specify the signal capture file size. Once the file is filled, recording continues at the beginning of the file, overwriting old data. Thus, you write over the "dead-air" and stop the capture once the signal is recorded.

Random access playback

Because recording is done to hard disk, you don't have to wind back through an entire recording session to review interesting signals. Instead, you can jump directly to every signal of interest marked during capture. An event log of all tagged signals is provided to help you. Of course, you can still play back the entire session if you choose.

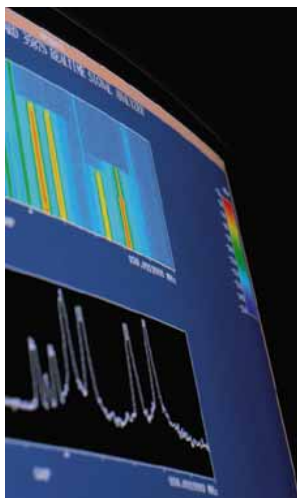
Additional DSP tools

Option ATR adds signal processing tools to the HP 3587 to help you analyze recorded data.

Focus in on narrowband signals using post-process digital filtering. Filter signals to maximize the signal-to-noise ratio in the analysis bandwidth. Whatever the recorded bandwidth, it can be reduced by a factor of 2^n ($n=1$ to 14). Use the digital LO to tune the center frequency of these filters anywhere within the original recorded bandwidth.

File management

Option ATR has a full set of file management tools, so you can record multiple files, assign file names for each session, add comments to the file header to document the session, write protect the file, delete the file, copy to/from the controller system disk, and archive signals to DDS tape. Speed the archiving process by saving only the portions of a capture file that contain interesting signals.



Use option AGG to create customized measurement tools

Option AGG provides extensive customization capabilities to let you create measurement tools for your own applications. It also provides the necessary documentation to let you further customize the HP 3587 user interface for increased productivity.

Most customization tasks are straight forward. They require knowledge of file manipulation, HP-UX and X Windows systems and a text editor, only. However, developing your own display and marker functions, as well as accessing the software control port, does require working knowledge of C programming.

Create a custom user interface

Use Option AGG to customize menus and display attributes. Create new display or marker functions. Add "hot keys" to streamline measurements for your unique applications. Re-arrange existing functions or temporarily remove unnecessary functions. And, program a new downconverter.

Customize your displays

Using C subroutines, you can create or customize 25 different display types. If you can program an algorithm in C, you can use it as a display choice. What's more, your subroutines are smoothly integrated into the system's regular operation. Start with one of the measurement data types (frequency, time, or amplitude domain), select a graph type, insert your custom routine, then tell the system which units and scale factor to use.

Group custom displays in related families for ready access and provide your own Help screens to assist other operators.

To help you get started with sub-routine programming, the system software is shipped with a sample subroutine that performs AM and FM demodulation.

Customize your markers

You can also program custom marker routines. Your routine is integrated in to the system's regular marker operation. This makes it easy to use a custom marker to perform a specialized calculation without cluttering the user interface.

To help you get started, a sample marker routine is included that calculates intermodulation distortion.

Solve unique problems

And there's more. Option AGG lets you access signal capture and stored measurement files. It lets you add conversion programs for printers not supported in the standard system. And it provides macro programming to automatically run strings of commands with a single key press. Using the command port feature, you can access the HP 3587's application software from another process running in HP-UX, giving you the option to pull data into other programs and link operation with other VXI modules.

Add signal search capability

Use your HP 3587 as a signal search system by adding software. With this software your system functions as a wide-band signals development system capable of sweep rates in up to 2.3 GHz/s with 15 kHz RBW. This new functionality is called the HP E3238 signals development system. It has many features to compliment and leverage this speed.

Select from two search modes. Use general search to monitor a single spectrum segment as part of an environmental scan. Use advanced directed search (Option AS7) to automatically scan 100 user selectable spectrum segments without wasting time on the spaces in between.

Use the mouse controlled manual signal isolation tools in the HP E3238 directly on the signal trace. You don't have to take your eyes from an elusive signal to tune to it. Just drag a box around it with the mouse and the system will zoom the display to that signal. Point at the signal with the cursor and press the left mouse button to activate the frequency and amplitude marker. Tune a hand-off receiver to the signal by pointing at it with the mouse, or lock a hand-off receiver to the signal with simple drag-and-drop operation. Double click to return to the full scan display and look for the next signal.

Use the signal energy thresholds to automatically isolate signal energy from noise energy.

Use Option AS8, automatic alarms, for automatic energy characterization. Program this option to identify signals based on their frequency, amplitude, bandwidth and duration. Once isolated, have the system assign a hand-off receiver to the signal, record the digitized signal, notify the operator with a screen icon or audible alarm, or save the trace.

You can operate the HP E3238 via Ethernet LAN, accessing all features, displays and menus from any X-compatible server in your network.

Ordering information

HP 3587B	Real-time Signal Analysis System
Opt. AGG	Development Version
Opt. ATR	Real-time signal capture
HP 35687U	Software upgrades for HP 3587 Real-time Signals Analysis System
Opt. OCC	Revision upgrade
Opt. AGG	Development version
Opt. ATR	Real-time signal capture

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