8566A Spectrum Analyzer

- The initial concept of the "Ultimate Spectrum Analyzer" or "Doomsday Machine" as Marketing liked to call it started in 1967, model number 8560A.
  HP had just revolutionized spectrum analyzers with the 8551A Microwave Spectrum Analyzer, the first instrument capable of wide frequency spans without displaying duplicate signals. It used a backward-wave-tube oscillator that could be frequency stabilized by user adjustment and a 2 GHz first intermediate frequency amplifier, unlike anything in the past. The next generation, the 8560A, was to be solid-state, have 10 kHz frequency accuracy to 20 GHz and be programmable. Development cost was targeted as $600k and selling price as $13k.

- Small teams of engineers investigated for the next 6 years various new technologies like:
  - YIG tuned filter for preseslection and image rejection (YTF)
  - YIG tuned oscillator to replace the BWO (YTO)
  - YIG tuned multiplier with enough power to drive a fundamental mixer for sensitivity (YTM)
  - DC to 22 GHz fully balanced mixer on a suspended quartz substrate
  - Local oscillator with low phase noise and frequency accuracy using M/N synthesis
  - Combining phaselock with analog frequency sweep (Lock & Roll)
  - Complete redefinition of the front panel and user interface
  - Replacement of rotary knob controls and gear driven frequency dials by push buttons, a rotary pulse generator and on-screen numerical read-out
  - Vector display of spectrum traces and alpha-numerics on a CRT
  - Microprocessor control of analyzer functions in real time

- With time and cost overruns during the investigation, the whole endeavour was reset in 1973 and scaled down to the 8566A project. The YIG tuned multiplier, YIG tuned filter and fundamental mixer were to be replaced with a YIG tuned harmonic mixer (YTX) to reduce tracking problems with the YTO, but sacrifice microwave sensitivity. The project was fully staffed, reaching up to 20 R&D engineers at its peak, working in 3 teams on Frontend, Display and Mainframe.

- A parallel project was started in 1974, the 8568A RF Spectrum Analyzer, as a lower cost alternative where 1.3 GHz coverage was sufficient. It used all of the 8566A technology except for a different front end and LO stabilizing techniques. The 8566A local oscillator and the YTM became key components in a new line of sweeping microwave synthesizers.

- The 8566A was introduced to the market in December 1978 at a selling price of $47.5k. It was the most expensive piece of test equipment HP had offered. It took 53 engineering-years to develop at a project cost of $5,325k. The project yielded numerous patents in the areas of sweeping synthesizers, mixers and CRT display of signal traces. The product was obsoleted in 1998 after having been the industry standard for fast automated Microwave and RF spectrum measurements world-wide for nearly 20 years.

- The final 8566A covered a frequency range from 100 Hz to 22 GHz with 10 Hz resolution and computer control. Gone were the vernier dials of previous test instruments and replaced with push buttons. Every control could be sensed and set by computer. An internal central processor optimized the performance of the YTX front-end and the "lock and roll" local oscillator. All unnecessary internal functions were put on hold, while the analyzer took spectral data, to avoid erroneous displays. The speed of measurement and data transfer was unmatched for many years.

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