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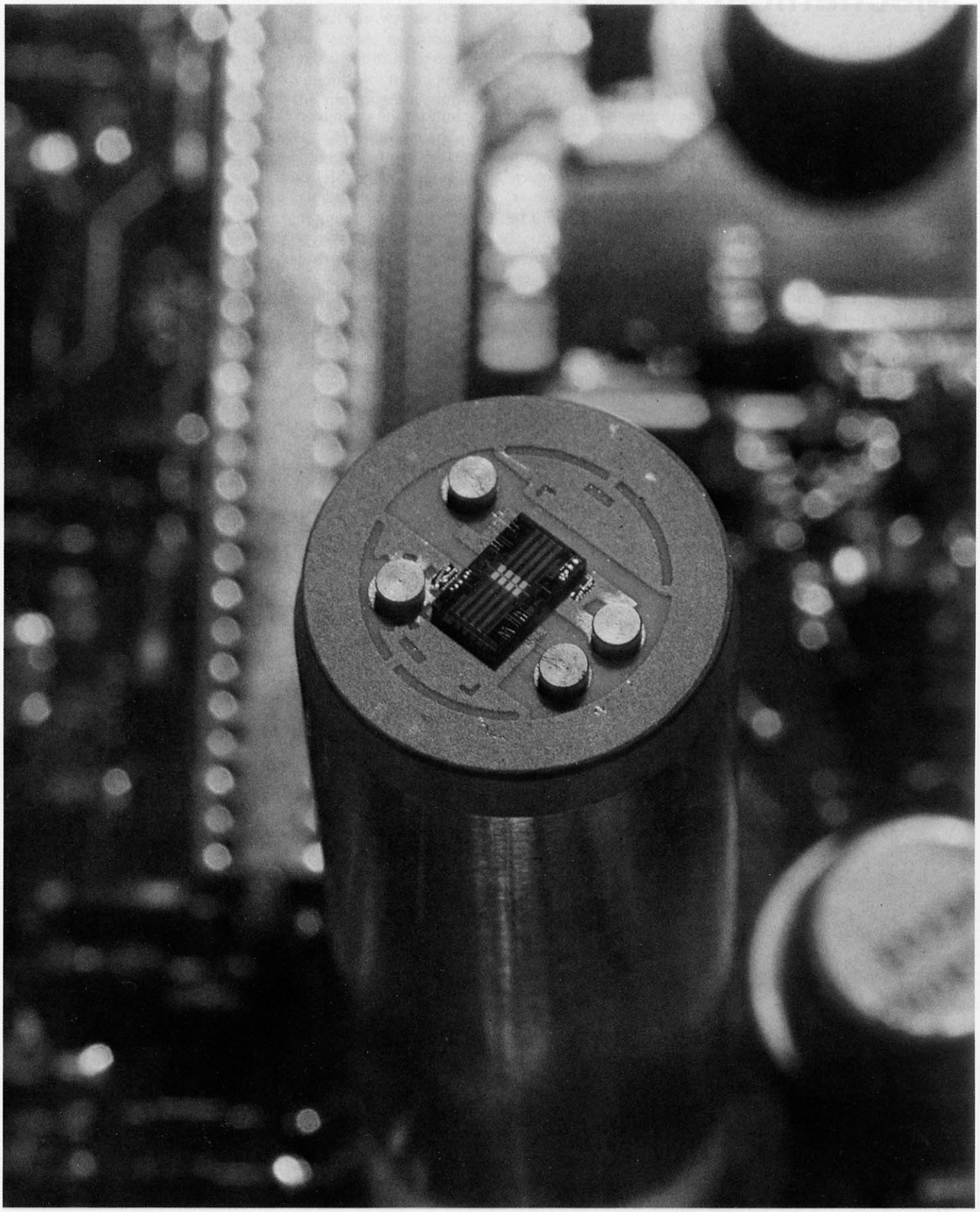

Internally Modular Signal Generator Mechanical Design

by Michael B. Jewell and Mark W. Johnson

ONE of the principal goals for the mechanical design of the HP 8642A/B Signal Generator was to provide effective shielding to ensure high performance without sacrificing serviceability or ease of manufacture. This ruled out "stiff" RF gaskets, large numbers of screws, retaining nuts for RF connectors, and covers that can't be removed without unsoldering components.

The design that realizes these goals divides the circuitry into functional blocks or modules. These modules are treated as small, complete instruments that have well-defined input and output specifications, require minimum external inputs (power, digital control, and RF signals), and can be completely built and tested before final assembly, which then requires a minimum of testing and adjustments for the assembled instruments to meet specifications.

The module design is illustrated in Fig. 1. Each consists of two printed circuit boards sandwiched between three die castings for shielding. The printed circuit boards have ground planes on both sides extending to the edges and between all sections that need shielding from each other. Through these areas are many closely spaced plated holes connecting the two sides of the board, thereby effectively forming a continuous ground plane, which prevents RF energy in the board material from escaping. These ground plane areas are also the places where the cast base and cast covers make electrical contact through the main RF gasket material.

All RF connectors and power or control feedthrough fil-

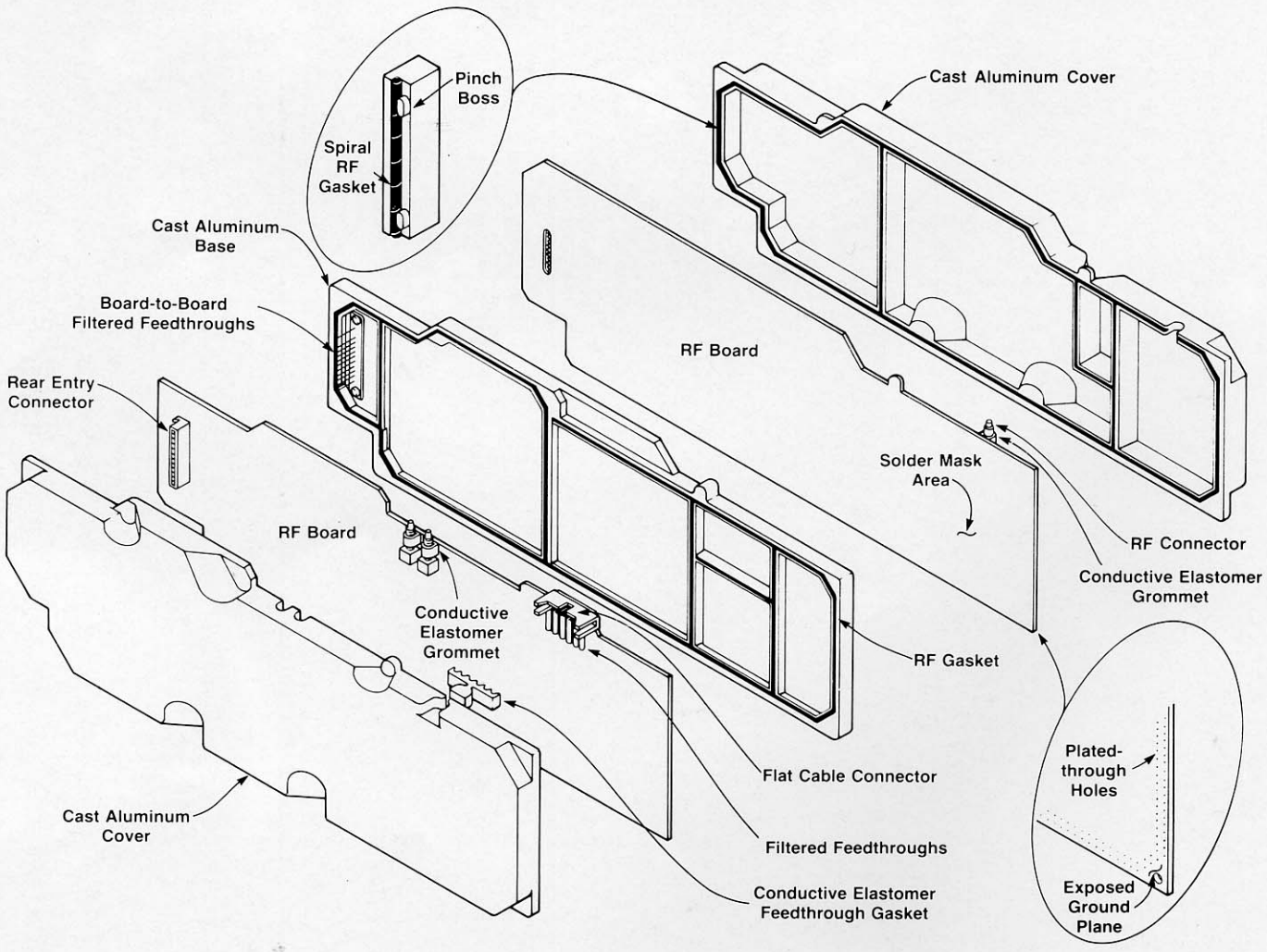

Fig. 1. *HP 8642A/B functional module construction.*

ters that must pass through the shielding are grounded immediately at the shield by conductive elastomer grommets. This ensures that a good ground connection is made immediately at the shield, which is optimum for keeping RF noise on a wire or cable outer conductor from radiating inside the shielded enclosure. Yet, when the screws that hold the cover on are removed, there are no additional nuts, solder joints, or other connections preventing removal of the cover, and all electrical components are intact and functional, allowing operation of the circuitry for troubleshooting.

Power and control lines come to a module over a flat cable from a power and digital distribution board (Fig. 2). This cable attaches to one of the boards in the module. Printed circuit traces then lead to the filter feedthroughs mentioned above. Power and digital signals are delivered from this board to the other board in the module through feedthrough filters, which are attached to the base casting and plug into rear-entry connectors on each board.

The main RF gaskets are spiral-wound metal strips, which are attached to the castings by being pinched periodically between a low wall and short bosses as shown in Fig. 1. Because the gaskets are soft and the castings are stiff, few screws are needed to hold the covers on, thereby greatly improving serviceability.

The sandwich design provides for a continuous ground connection, which completely surrounds each shielded section of circuitry—above, below, and through the printed circuit board. Compared to the older, more common practice of grounding boards at a few discrete locations, this technique provides much more predictable RF performance and much higher levels of shielding.

The custom die castings allow internal and external walls to be placed virtually anywhere, making possible a large number of shielded compartments on a single printed circuit board.

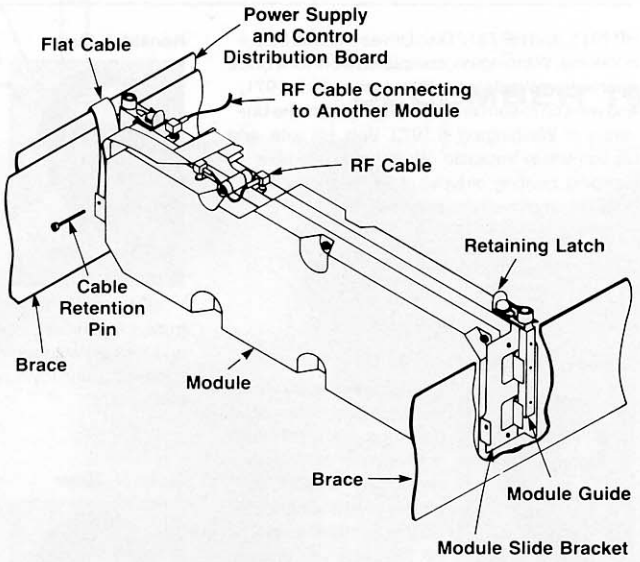

Fig. 2. *Power and control lines come to a module over a flat cable. Sliding snap fasteners secure each module to guides attached to the frame.*

Thermal Considerations

The thermal conductivity of the aluminum castings tends to provide very uniform temperatures inside the modules even when power is concentrated in certain areas. In addition, the number and location of air holes can be tailored

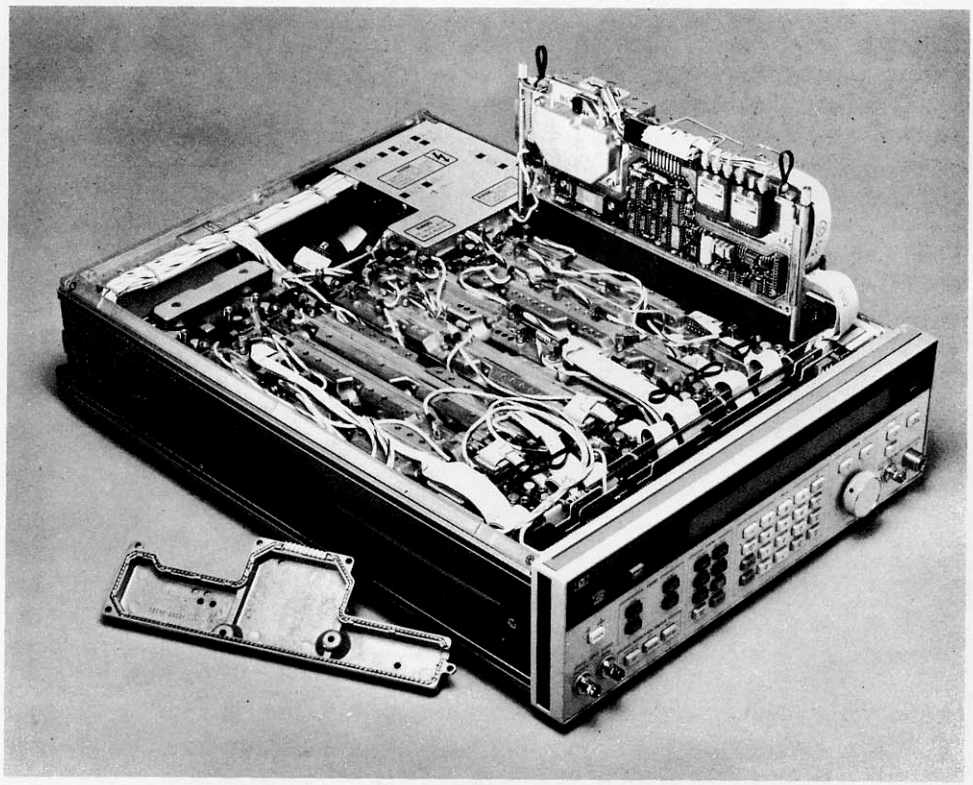

Fig. 3. *Module pulled out and covers removed for service.*