Building the Ultimate Receiver

Trials and tribulations on the road to a dream!

by Bob Grove

If you're like me, after a few years of going through used receivers and new receivers -- good and bad -- you begin to fantasize about owning the world's finest receiver, a dream receiver with superb selectivity, sensitivity, audio quality and frequency coverage.

It was just such daydreaming in 1984 that led to an earnest effort to design a radio that would have incredible listening power. But how does one go about taking on a project of that magnitude? After all, such a design would have to be innovative and fresh, not a typical off-shore "knock-off" of an existing receiver.

After contacting a number of industry authorities, it became painfully clear that RF (radio frequency) design engineers are hard to find and, when they are found, they are expensive. It was not uncommon to get quotes in the neighborhood of $50-60 per hour for research and development!

But the dream went on. I began to compile lists of desirable features and specifications, finally submitting them to a firm in California which started initial development. Their initial price quotes were attractive and their work was good. A few weeks -- and a few thousand dollars -- later, a basic block diagram was forwarded for my inspection and approval. Attached to it was a tentative cost for development: $150,000!

I still remember the nauseous, whirling sensation as I attempted to fully grasp the significance of that figure. Sure, RCA could probably handle such a figure; so could ICOM, Kenwood, Yaesu and the rest. But I could see my home being auctioned off to the highest bidder!

Low key for a while

Clearly, it was time for regrouping. Surely there must be a competent, independent design engineer working out of his basement who doesn't have overhead expenses who would just love to do the job as a challenge. While such individuals do, indeed, exist, many of them are mavericks and prove undependable.

Still smarting, disappointed and somewhat disillusioned, I decided to "put the project on a back burner" for a while. The dream was far from dead, but the cost -- emotional and financial -- was unrealistic at that point.

Then a series of coincidences turned up an experienced, qualified RF design engineer who also knew the radio hobby and whose intuitive skills would prove invaluable. In the meantime,

several off-shore-manufactured receivers emerged with severe shortcomings. Clearly, a better product was needed. Code-named Explorer, the project was reborn.

The art of specmanship

How do you arrive at a list of specifications that will make everyone happy? You can't. No matter what you do to come up with "ideal" specs, they are only ideal for you. For example, international broadcast listeners would like a choice of filter selectivities to combat any adjacent interference: 12, 6 and 4 kilohertz would be nice.

Utilities (two-way communications) listeners are even more adamant in their filter selections: 2.8, 2.4, 2.1 and 1.8 kHz for SSB; 1 kHz for RTTY and FAX; 200, 300 and 500 Hz for CW; 180, 40 and 15 kHz for wide, medium and narrow band FM. Clearly, there is no satisfying some people!

And how about the power source? 120 VAC for US electrical systems or dual 120/240 VAC, 50/60 Hz for domestic and foreign requirements? How about 12 volts DC for mobile applications? And what about power adaptors?

Just how wide a frequency range should the receiver cover? 100 kHz-30 MHz? 30-960 MHz? 100 kHz-1000 MHz? 10 kHz-10 GHz? "DC to daylight" coverage, as wag engineers call enormously-broad frequency capability, is usually impractical and always expensive.

Some specs are easier

Fortunately for the beleagured engineer, some specifications everyone agrees with: high frequency stability, freedom from mechanical or electronic drift; wide dynamic range, permitting weak and strong signals to be handled without desensitization, intermodulation, images or dynamic compression; accurate digital frequency display; and low-distortion audio reproduction.

LET THE GAMES BEGIN

Finally, late in 1987, development began in earnest. Several leading communications receivers were studied to determine their strong points and shortcomings. Initial designs were made and the paper chase began -- no sooner had one idea developed than another overtook it. As one subsystem was conceived, a better approach would bump it.

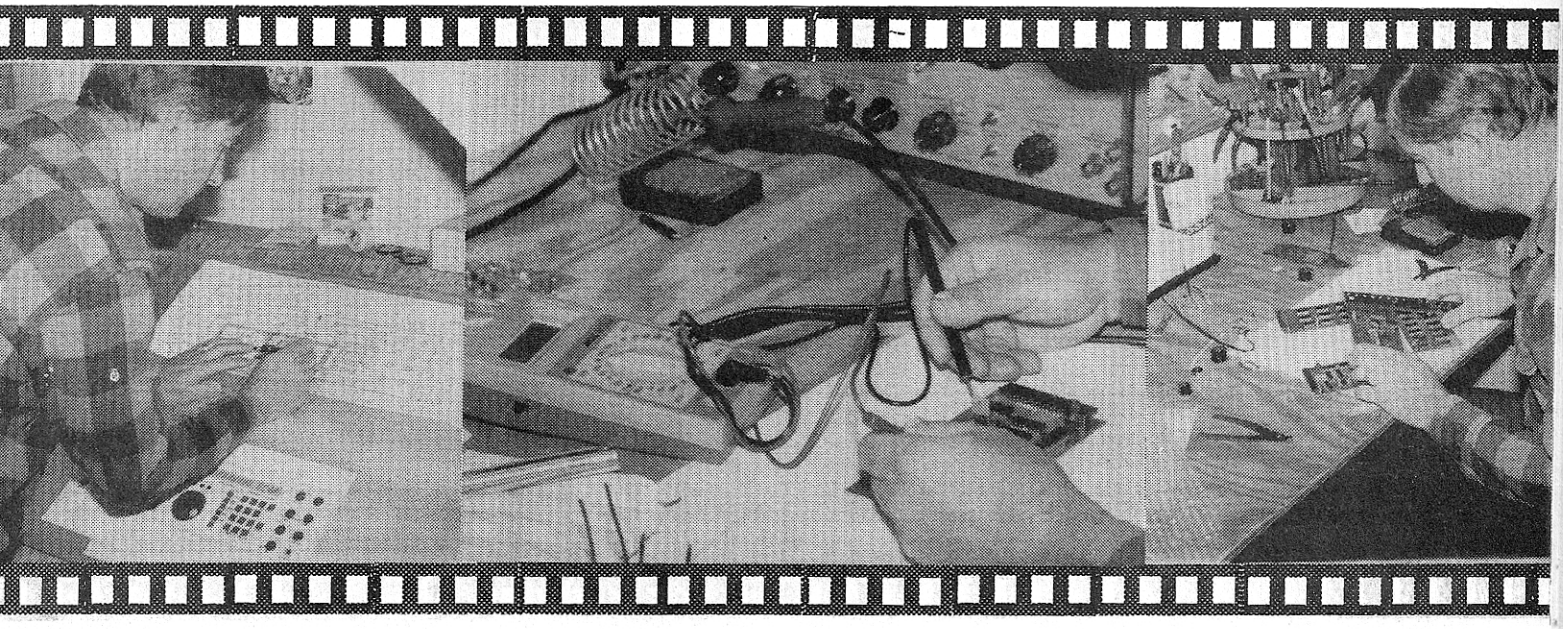
The classic battle between marketing and engineering was on. Salesmen want a receiver with incredible features to sell for peanuts -- and they want it *now!* Engineers know that every "improvement" requires extensive design changes, sets the development program back and costs money. It's an age-old saga.

The Hallmarks: an SDU and wide frequency coverage

The spectrum display unit (SDU) is an awesome intercept tool previously available only on costly commercial, military and government receiving equipment. While conventional scanning and searching circuits laboriously crawl through the spectrum hoping to fall upon an active signal, an SDU visually displays all signals -- simultaneously -- in an entire band. If a new signal pops up, the user quickly tunes it in. He doesn't depend upon chance.

The frequency range of 100 kHz through 1000 MHz -- with no gaps -- covers the vast majority of listening interests. Filter selectivities are expected to be: AM (6 kHz), USB/LSB (2.4 kHz), wideband FM (180 kHz) and narrowband FM (15 kHz). Other signal processing controls allow optimum peaking.

But then the delays came ...



It was originally hoped that the new receiver concept, now designated the SR1000, would be ready to show at the 1988 Dayton Hamvention. But, true to form, more improvements meant inevitable changes -- along with accompanying delays. All that could be shown was an artist's conception and a bunch of prospective brochures -- how embarrassing! And now the 1989 Dayton Hamvention is at hand.

In an industry first, the SR1000 will sport for its SDU, instead of the cumbersome glass cathode ray tube (CRT), a liquid crystal display (LCD)! Making the receiver smaller, lighter in weight and lower in cost, the LCD requires no high voltages, meaning that the SR1000 can operate directly from 12 VDC power as well as from AC mains with an inexpensive power adaptor.

Tired of only 100-300 memory channels? How about 1500?! Channels are selected by direct call-up from a keypad or by sequentially stepping through them with a tuning dial. A scanning module is planned for later.

You say it would be neat to control such a receiver with a computer? The SR1000 has an RS232C port allowing complete computer control of all microprocessor functions.

Coming to grips with costs

The most painful part of merchandising is arriving at a competitive, honest price for a product. While similar surveillance receivers for military, government and commercial interests start at $10,000 and skyrocket from there, those of us with ordinary, flat wallets could never consider such an investment -- regardless of our enthusiasm or the quality of the product.

Early estimates indicated an actual manufacturing cost of around $1600; with the normal 3-5 times markup that manufacturers won't admit to, that could put the suggested retail at a whomping $8000. While such a price is low for the professionals, it is unreachable for most of us hobbyists.

Finally, after considerable soul searching and profit wrenching, it was decided that the receiver would have to sell for under $3000 to make it a reasonable alternative for those listeners who would have to spend that or more for separate pieces of equipment which would only begin to approach the flexibility and performance of the SR1000.

While such a low profit margin would not support the overhead of an international Japanese manufacturer, it does allow a comfortable margin for Grove and our dealers.

But when?

Several steps are necessary between assembly and marketing, not the least of which are field testing of the prototype and FCC certification. Even with perfect results, it is inevitable that something will go wrong, necessitating minor modifications to circuit board layout.

During a recent amateur radio network conference, I was told that the amateur community would be glad to see the SR1000 because it was considered just so much "vaporware", a derogatory term for a proposed product that never sees the light of day.

While the insinuation hurt, it wasn't totally undeserved; the "imminent" arrival of the SR1000 was announced over a year ago. A building has been purchased for the exclusive production of the SR1000 in second quarter, 1989.

For those myriad callers who want the first one, you'll have to wait; that one's MINE!

For additional information on the SR1000 Spectrum Surveillance Receiver send an SASE to Grove Enterprises, P.O. Box 98, Brasstown, NC 28902.