Solid-state vs. tubes in TV transmitters

The last stand of the final tube: showdown or standoff?

By Skip Pizzi, technical editor

Most large-scale technological transitions take place gradually. The new innovation replaces the old standby over a period of time. How quickly the phase-in process occurs is usually due to how improved the new technology is over the old way, especially in terms of cost-effectiveness.

This scenario has unfolded numerous times as electric recording replaced acoustic, magnetic recording superseded mechanical transcription, color supplanted black-and-white, stereophonic mono and as digital now outpaces analog.

An example of such technological transfiguration is the conversion from tubes to solid-state devices. The transistor is responsible for no less cataclysmic a development than the so-called second industrial revolution. However, just as the steam engine wasn’t instantly integrated into our society in the first run of that series, neither was the transistor in the sequel.

Now that the solid-state transition has run its course, a technical world of tubes alone seems almost as bygone an era as those pioneers of steam. You can only ponder how things might be today had that second revolution not taken place. It is hard to believe that it has all happened within our lifetime. (Well, for most of us at least.)

The conversion is so complete that most electronics courses today begin with semiconductors, and make only later or passing reference (if any) to tubes. Nevertheless, there are a few places where vacuum tube technology has not given way to solid-state devices, and the broadcast transmitter is among them. It’s in good company, with military and other vital secure-radio links employing tubes for their immunity to the electromagnetic pulse (EMP) predicted in the case of nuclear war, the telecommunications industry sticking with tubes in satellites and their uplinks, and the high-end recording studio and audiophile communities using tubes (often expensive or difficult to find) in their classic microphones and esoteric power amplifiers.

In all of these cases, with the juggernaut of a solid-state invasion to contend with, there must be significant reason for these pockets of tubes' survival. Final tubes in broadcast transmitters have held off the onslaught for a number of good reasons, and it should come as no surprise that the ever-present cost-effectiveness issue is one of them. However, even this high-powered province has now been challenged by solid-state devices, and fully solid-state transmitters are coming on-line in every broadcast band.

Nevertheless, the state-of-the-art is not inactive in the world of vacuum tubes, where new developments continue as applications warrant.

Broadcast Engineering felt that with the battle thus engaged, the two sides should be presented on neutral turf. Two articles dealing with solid-state and tubes are a sort of point-counterpoint by some practitioners within both parties of the fray. Although it is unlikely the dispute will be settled, these two articles may help you understand the relative merits of these divergent approaches. In any event, the broadcaster benefits from the improved hardware that results from such techno-sparring, because there is no better incentive toward excellence than a worthy opponent.