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# Spotlight on Passive Components

Tom Perkins  
Sr. Technical Editor



Have you noticed the proliferation of technical webinars in recent years? These webcasts usually require advance registration, and allow sign-in with an event password about 10 minutes before start time. There is usually a host who introduces the speaker(s). Questions are encouraged and can be entered in an on-line “chat” during the lecture. At the end there is usually about 10 minutes for the host to read questions and solicit answers. If a panel of experts is available, questions are often answered in greater depth than if the burden is placed strictly on the speaker. While these presentations are generally skewed towards promotion for the products described, such as test instruments, technology tutorials such as radar, LTE, MIMO, electronic warfare, etc. are sometimes sponsored by parties not directly hyped in the presentation. An engineer, technician or other interested party can get valuable information without leaving the workplace and consuming costly travel, lodging, and time. Missing, however, is the interaction with peer groups, although viewing with a group is certainly feasible.

I mention this resource because a recent presentation by Agilent Technologies was particularly well done and demonstrates the value of such media. The title is: *Signal Analyzer Fundamentals and New Applications*. The speaker, Erik Diez, in this case a Senior Product Manager, explained spectrum analyzers in a succinct manner. Signal analyzer measurement techniques and the abilities of modern equipment with digitizing were very enlightening. The discussion explained resolution, sensitivity, distortion products, dynamic range and more. His explanation of Second Order Intercept (SOI) and Third Order Intercept (TOI) and relation to harmonic distortion from non-linear devices was the best I’ve ever heard or read on that subject matter.

These webinars are generally well prepared and scripted to sync with the graphics shown. The speaker is often never seen, only heard—maybe something to be tweaked a bit.

## Passive Components

On another subject, we have occasionally received comments that more should be said about passive components. As I pointed out in my February editorial, passive products seem to be a bit more enduring and stable relative to longevity of suppliers. In March I spent some time with Ralph Baer who is generally credited with inventing early video games, and still is inventing and developing children’s toys at the young age of 91. He was recently made a 2013 IEEE Fellow, something that should probably have happened 30 years ago. Louis Terman, son of the acclaimed Frederick

Emmons Terman and IEEE President in 2008, played a role in making this honor happen for Ralph. Having discussed the tremendous influence of Terman's texts with Mr. Baer, I pulled the 1947 Third Edition of Louis' father's book, *Radio Engineering*, off my not-so-current bookshelf. In the Preface this late edition states: "In particular, greatly increased attention is given to ultra-high-frequency and microwave techniques, also to wide-band and pulse methods such as encountered by television and radar. A chapter on circuits with distributed constants has been added that summarizes the principal properties of transmission lines, wave guides and cavity resonators."

### **In the Beginning**

In the two decades commencing shortly before WWII, passive circuitry dominated the then-called "ultra highs" and microwaves. The new Chapter 4 discussing "Circuits with Distributed Constants" immediately followed the previous chapter describing lumped constant circuits. So, over a brief span of 15 years since Terman's 1st edition, in 1932, high frequency electronics took on significant importance. Tube oscillators, klystrons, and magnetrons found their way into the third edition also, in a later chapter.

### **Great Technical Advances**

I must admit that I tend to discuss, maybe too much, the latest and greatest active circuitry. Much of the hype in our industry is placed on the newest III-V semiconductor technology and high speed circuit processing. Often ignored are passive circuit components that make up parts of just about every circuit in our business. We have some wonderful companies that advertise with HFE that manufacture power dividers, attenuators, terminations, couplers, chip resistors, chip capacitors, inductors, passive mixers, coaxial connectors, cables, filters, circulators, isolators, waveguide components, switches, antennas, cir-

cuit boards, frequency multipliers, rack assemblies, absorptive materials, metamaterials and more.

There have been significant advances in many of these component technologies. An explosion in varieties of connectors, advances in bandwidth coverage of passive chips, a plethora of dielectric substrate choices, improved filter performance, much improved

reliability, and new materials and automated fabrication techniques have enabled improved and smaller components and subsystems. The engineering discipline involved is sometimes now called "mechatronics." More later ...

See you at RFIC and IMS 2013, Seattle, June 2 – 7. More than a webinar!