
RF Desk Reference Review

By Gary Nixon, [WA6HZT](#)

When I was first approached to do a review of "The RF Desk Reference for Wireless Communications", I hoped a book that considered itself a desk reference would be complete, comprehensive, and of use to novice and seasoned radio people alike. I was pleasantly surprised to see just these things represented in the eleven-chapter Table of Contents, starting with the basics of the decibel through advanced RF topics such as "Bessel Functions."

Here, author R. Harold Kinley, WA4GIB attempts to fill the void he feels has been left by schools and colleges in "properly presenting" RF technology and techniques, and he makes an excellent effort in that direction. While the book is not a complete treating of all things "RF" and, by his own admission, is not a "panacea" to fill that need. The book provides the newcomer with a solid grounding in things RF, the practicing engineer or amateur radio operator with material to bridge knowledge gaps and fill in blanks, and while giving the seasoned professional a compendium of standards to reference.

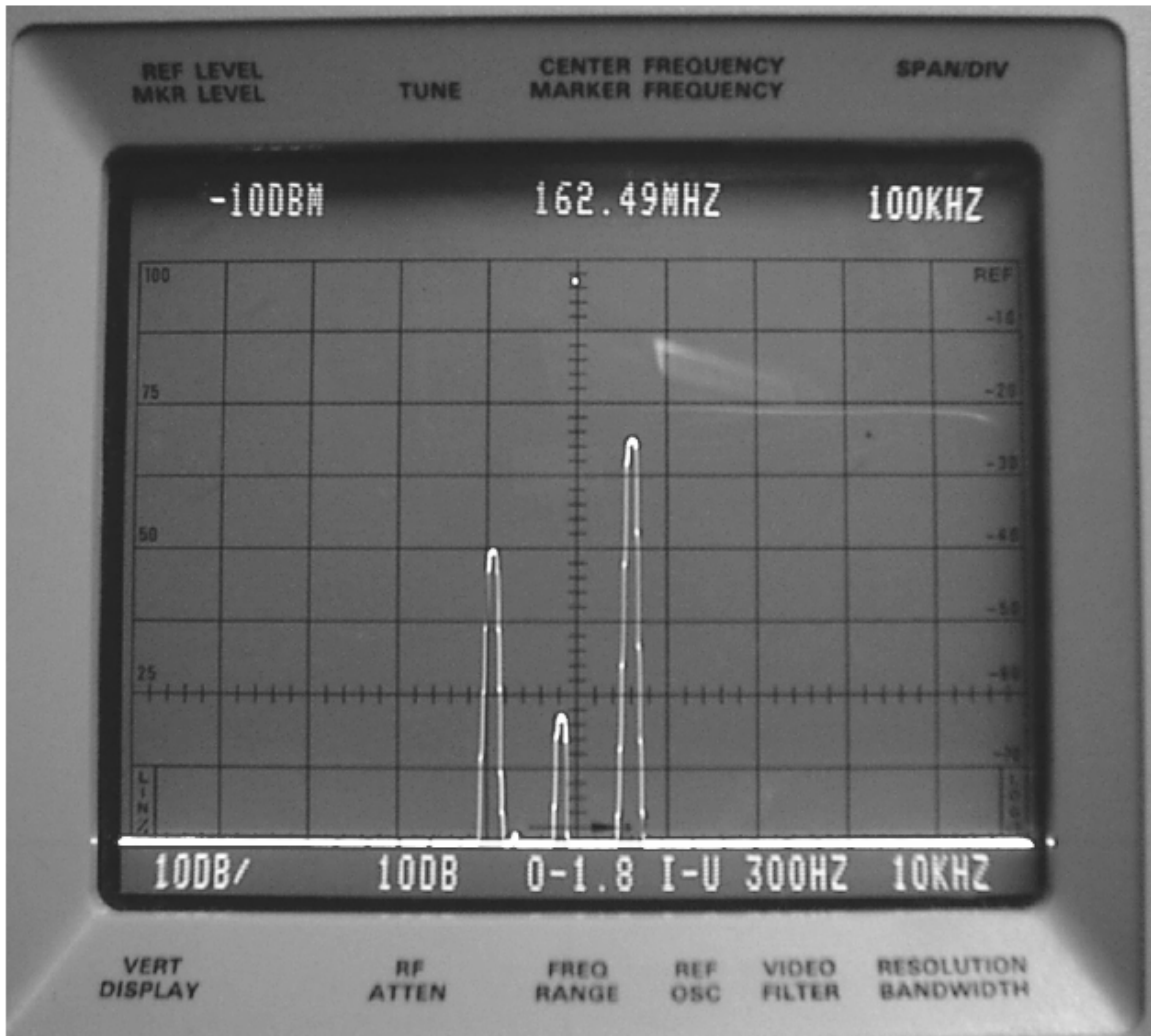
Beginning the 340+ pages of material is an overview of "RF Units of Measure", including the decibel, the core unit of measure in the land of radio, and a necessary primer for those unfamiliar or rusty on what it tells us. One also gets the sense, even in this first chapter, that clear illustrations of concepts and practical examples will become part and parcel of the book as it unfolds; this sense is confirmed through later chapters. Critical to understanding and using the decibel with regard to both power and voltage, these differences are laid out plainly with many examples given to help solidify this important concept. The chapter concludes with RF Field Strength units of measure beginning with the benchmark Microvolts-per-Meter, continuing through power density theory and calculation. This latter topic is of great interest these days, as pointed out in the book, to determine "maximum permissible exposure" to RF, whether it be commercial or amateur in nature.

Figure 1.4 This graph shows the equivalent decibel gain or loss for voltage ratios from 1 to 10,000.

Increase	25%	60%	100%
Power	1dB	2dB	3dB
Voltage	2dB	4dB	6dB

Chapter Two introduces the Smith Chart, the industry standard in graphically representing an antenna's Impedance. This is prefaced by a brief discussion of *why* we are interested in an antenna's Impedance, again showing Kinley's "why and wherefore" approach to the material in the book. If seeing " $Z = 50 - j15$ " makes your eyes gloss over right now, they won't by the time you have finished the chapter. Yes, there is some algebra to contend with, but it is methodically presented and, when taken in bite-sized pieces, even those of us with math anxiety can work through the formulas. The Smith Chart itself is then explained, building on the information just presented. Computerized Smith Charts are also discussed, even giving the reader a link to free charting software. The words "profusely illustrated" are frequently seen in book reviews - in this book's case, that is a valid commentary.

Chapter Three heralds the first of several chapters featuring the various pieces of equipment used in measuring RF. Specifically, Chapter Three deals with using a spectrum analyzer. This piece of equipment, for those not familiar with it, allows one to view a slice of radio spectrum that includes every radio signal within that range. This helps with diagnosing interference, among other things. The stated goal of the chapter is to teach how to get the most out of a spectrum analyzer while minimizing errors in measurement. A block diagram and description of a spectrum analyzer circuit are presented first to set the stage for the information to follow. A very large number of pictures and screenshots are then provided to support every major parameter, measurement, and application a spectrum analyzer is capable of. I say major because all of the uses and features of these pieces of equipment are too numerous to mention, and this is also acknowledged in closing out the chapter.



Test and Measurement instruments are highlighted in Chapter Four. Logically following the introduction to spectrum analyzers in the previous chapter, this chapter reviews more advanced and commonly used gear. This list includes service monitors, Wattmeters of several varieties, voltmeters, RF signal generators, FM deviation monitors, frequency counters, antenna analyzers, and more. Suffice to say, this chapter is loaded with solid practical information with the now familiar abundance of graphical support of previous chapters. This chapter may be one of the most helpful to the new Ham or technician in that it puts a "face" on many of the tools of the trade while explaining the equipment's worth in everyday situations.

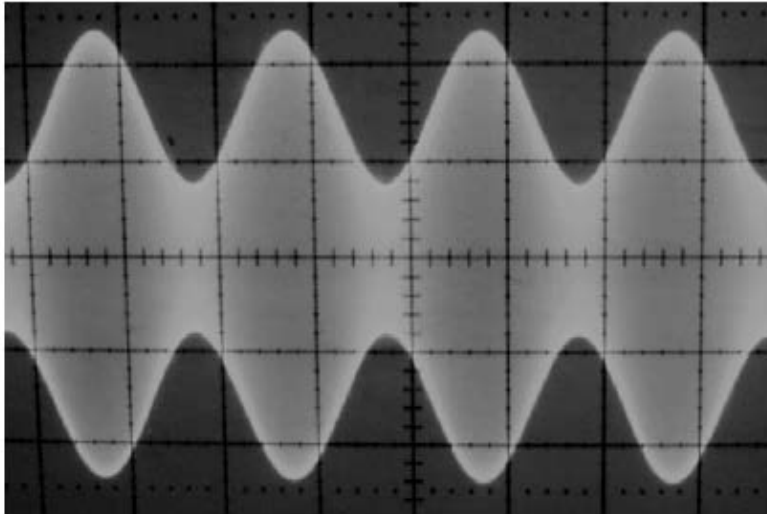


Photo 4.10 An oscilloscope display of a signal modulated at 50% AM.

On to Chapter Five and the further study of RF Test & Measurement Accessories. Here, the peripheral devices of equipment already described are presented. Subjects of discussion in this chapter include dummy loads, terminations, signal samplers, signal combiners and dividers, return loss bridges, attenuators, directional couplers, test probes, RF filters, connectors, cables and adapters, and more. And, I should restate that not just the theory of operation of these devices is given – the “how to use them” information is prominent and the supporting graphics leave nothing to the imagination in seeing and understanding them.

The next two chapters steer us away from the hardware aspect of RF measurements and toward some additional types of signals we might have need to monitor. Again, it is clear the author has extensive bench experience and understands what “real world” parameters are important to address. Chapter Six, entitled, “Intermodulation, Transmitter noise & receiver desensitization”, is a prime example. Each of these factors – and more – come into play in the field, especially so for Amateur and Commercial two-way technicians. In typical fashion, the focus is one of first understanding the issues to encounter, then looking at the ways of resolving them.

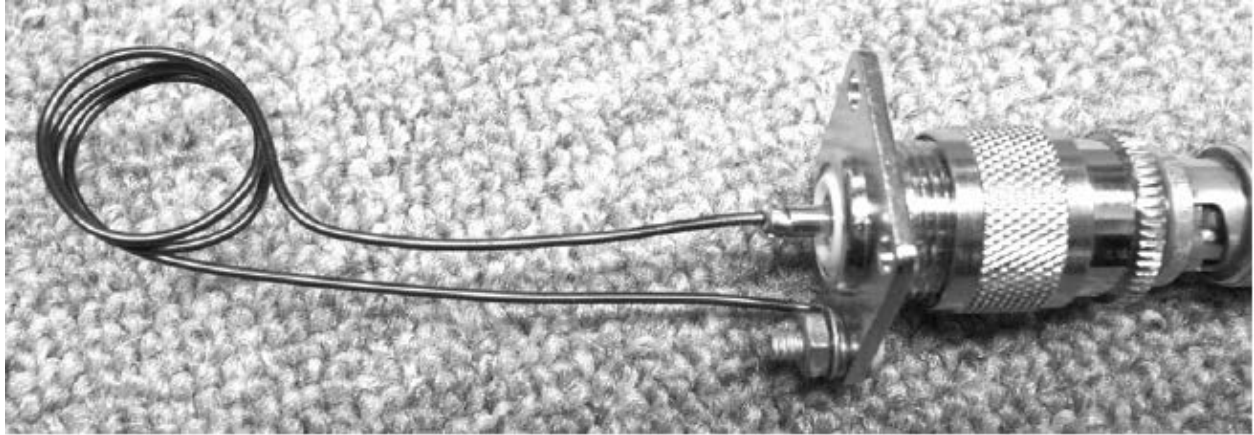


Photo 3.4 A small “sniffer” loop probe like this can be made winding two or three turns of solid wire into about an inch diameter and attaching it to a connector such as an SO239.

Having personally fought many “intermod” demons in my time, I found Kinley’s description clear and accurate, which is particularly important for the new technician. Understanding intermod is the key to solving it, and Intermodulation in its various forms is clearly and cleanly laid out. Many practical, real world examples are given, as we have come to expect. Many remedies, including filters and isolation, are also covered, as well as an end-of-chapter look at “desense”, or receiver desensitization, an all-too-frequently encountered situation in the field.

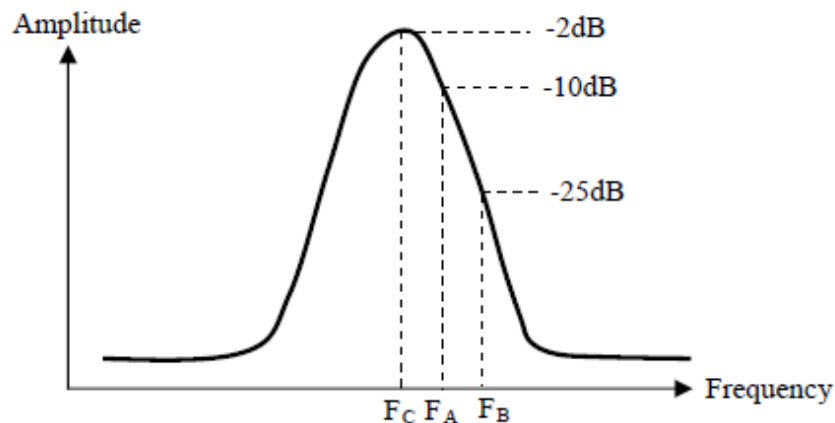


Figure 6.10 A bandpass filter with this response shape can be used ahead of the receiver to reduce the level of the intermodulation products while causing little attenuation to the desired signal.

Chapter Seven continues on this theme with the more general topic of site noise. That is, as the author states it, defined as the “ambient noise generated at a fixed transmission site.” The expected discussion of the problem and ways to mitigate it is again used effectively. A lengthy discussion of signal-to-noise ratio kicks off the chapter. Such is coupled along with nine pages of simple setups one can use to determine the effect

site noise is having on a particular system, each with a diagram or spectrum analyzer screenshot showing the concept or its effect in a working circuit. As it was with intermod in the previous chapter, understanding these key concepts is of great help and use to the field technician. Amplifiers, noise figures, receiver overload and vehicular noise round out the chapter, but the end piece is one of special note: a summary of “Points to remember”, pulling together the nuggets of Chapter Seven into a few bullet points. It helps gel the contents of the chapter both visually as well as conceptually.

Back to hardware in Chapter Eight, with an in-depth look at some of the filtering devices discussed earlier – in this case, coaxial cavity filters. Starting with bandpass filters, theory meets practice with cutaway diagrams of a typical filter’s construction all the way through the all-important concept, and application of, critical length coupling cables between filters. Again, for the new technician, knowing this is an issue ahead of time will save a great amount of grief and effort and it is good to see this information so prominently showcased. Also discussed and graphed is the concept of insertion loss and its associated tradeoffs. Another summary with bullet points closes out this chapter, again effectively highlighting the most important concepts of the chapter.

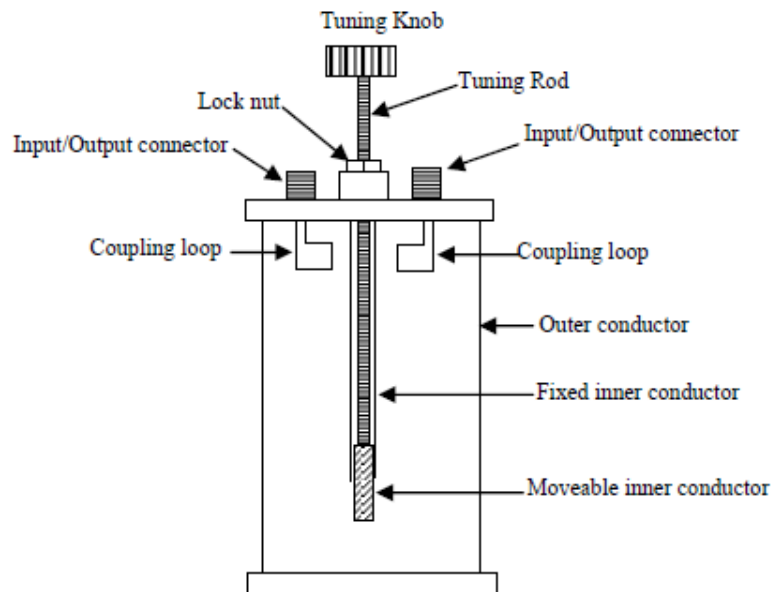


Figure 8.1 This is a cutaway view of the inside of a bandpass cavity. The tuning rod is usually made of an alloy called Invar—short for **in**variant. This alloy has a near-zero temperature coefficient, resisting any expansion or contraction with widely varying temperatures. Expansion or contraction of the tuning rod would cause significant changes in the resonant frequency of the cavity.

Chapter Nine continues with more hardware, billed as, "Special RF Equipment for Communications." Duplexers, isolators, couplers and combiners get the treatment here. Each is presented with theory, graphics, and examples in typical Kinley fashion. Here is where the repeater owner, or prospective repeater owner, can get a good grounding in duplexers, a necessary part of most repeater systems – and the author gives them their full due, including another gem for the uninitiated: the use of double or solid shielded cable between duplexing components. The chapter finishes out with a discussion of receiver multicouplers and transmitter combiners, subjects that may not be of need to most Amateur operators, but of potential use once understood. Much theory, diagramming and configuration information is given, and here, instead of a series of bullet points to summarize the chapter, a diagram of a complete system using all of the components covered in the chapter is presented to illustrate the material.

Critical to every RF installation is an understanding and proper application of transmission lines and antennas, and they are the subjects of Chapter Ten. It should be obvious that no complete knowledge of these things can be accomplished in one chapter of a book, and Kinsley's approach is only to explore transmission lines and how to solve common problems associated with them. At the top of the chapter is the king of antenna jargon, the standing wave ratio (SWR). Its most important concepts are explained and shown in graphical and mathematical form. Some of the topics included in this formidable discussion are the concepts reflected power, line loss, return loss, reflection coefficient, and a great section on practical transmission line calculations. A very light touching on a given antennas' most important concepts closes out Chapter Ten, and is a fitting way to tie the chapter's elements together.

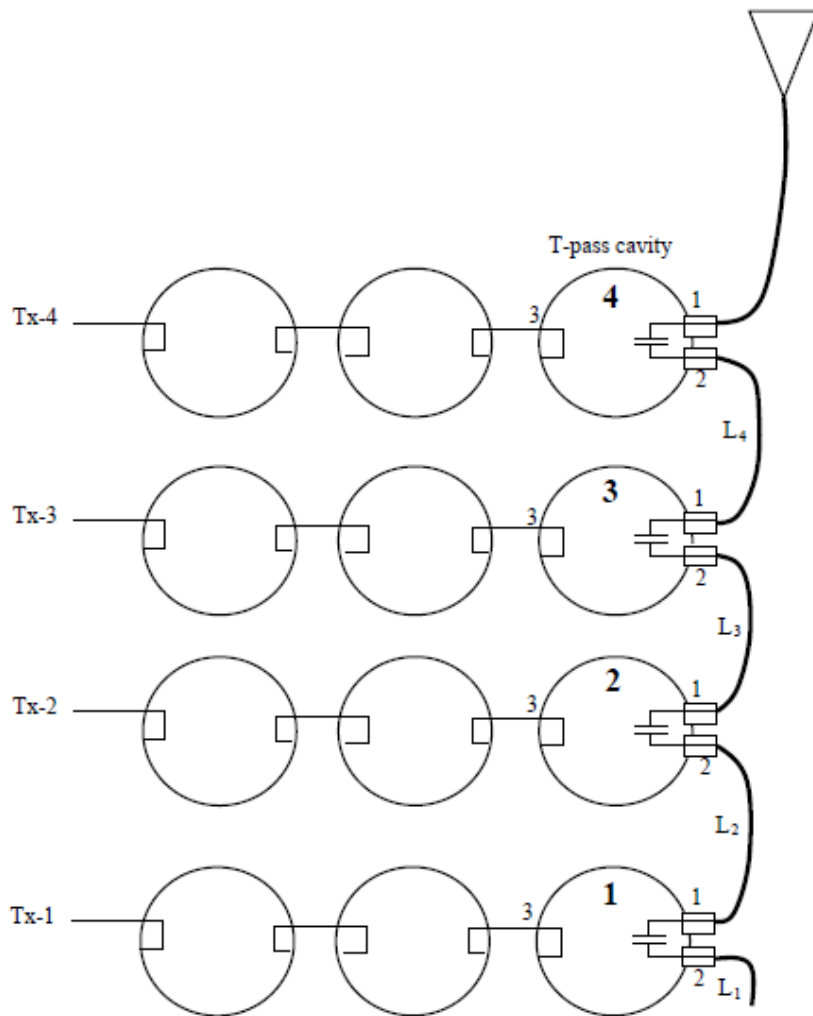


Figure 9.53 The T-pass cavity is used here to form an easily-expandable transmitter combiner. The T-pass cavity is a product of TX-RX Systems, a member of *Bird Technologies Group*. T-pass is a registered trademark of TX-RX Systems.

The eleventh and final chapter of the book brings together a series of “Special RF Topics”, like directional couplers, FM Modulation and Bessel functions (where was this when I needed it 40 years ago?), FM signal analysis, and more. Of the several things covered in this chapter, it was the information on amplifier K-factors that caught my eye. K-factor relates to amplifier stability, and it was good to see this material as part of the book, as was an extensive discussion of “S,” or scattering parameters. While they may not be of interest or applicable to everyone, their inclusion was a nice touch. Concluding the book, should you be so inclined to do so, Kinsley walks the reader through using the free QuickSmith software mentioned earlier to help design a low noise, small signal amplifier.

It is impossible to adequately convey the depth to which this reference book goes within the confines of a book review. I hope the brief overviews of each chapter have given you a fair sense of the book’s contents and breadth of knowledge conveyed. To return to the beginnings of this review, I believe a

technically-wide audience of readers is addressed by this book, and the old adage of "something for everyone" applies.

In my experience as a broadcast engineer and almost forty years of Amateur Radio, I have been exposed to most, if not all, of the subject matter in this book at one time or another and find it to be "spot on" in both content and delivery, within the limitations of keeping the material as relevant as possible given size constraints of the manuscript, as previously noted. As a new or old technician, I believe you will find this book enlightening and of practical use – the acid test of any reference material. **-30-**

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