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QST Issue: Dec 1991
Title: Shortwave Listening Guidebook [Helms]
Author: Robert Halprin, K1XA

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relationship between filter selectivity and insertion loss. Loss is also related to the components' unloaded Q (Q_u). The parameter Q_0 (normalized Q) summarizes these dependencies. Q_0 is defined as the ratio Q_u/Q_f, where Q_u is unloaded resonator (inductor) Q and Q_f is the filter Q, which equals filter center frequency divided by filter bandwidth. Fig 9 graphs filter insertion loss versus normalized Q.[2]

The 40-m filter of Fig 1 has a design bandwidth of 200 kHz—hence, a Q_f of 7/0.2, or 35. Building this filter using resonators with an unloaded Q of 250 results in a normalized Q of 250/35, or 7.1. The Fig 9 curve shows an insertion loss of about 2 dB for Q_0 = 7; this agrees with my measurements.

Fig 9 also shows that insertion loss becomes very large for normalized Qs of less than 2. As a reasonable limit, double-tuned-circuit filter Q should be no more than about 40% of the unloaded resonator Q.

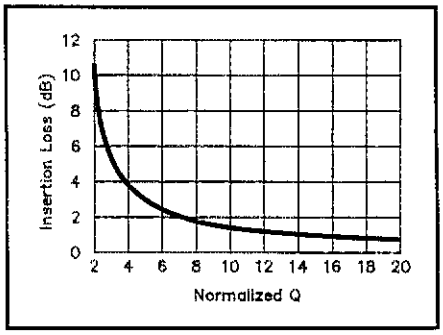

Fig 9—Double-tuned-circuit insertion loss versus normalized Q, Q_0 (unloaded Q [Q_u divided by filter Q [Q_f]). Higher insertion loss accompanies narrower bandwidths; a reasonable limit for the double-tuned circuit is $Q_0 > 2.5$.

Summary and Additional Thoughts

The double-tuned circuit can be summarized as follows:

1. Double-tuned circuits can be characterized by degree of coupling. A circuit may be undercoupled, overcoupled or critically coupled.

2. A double-humped response indicates overcoupling, and rarely has anything to do with stagger tuning.

3. An experimenter may overlook the "other" peak in a severely overcoupled circuit because it may be far removed in frequency from the observed peak. Builders should take special care to avoid mistaking one of two peaks as the single peak of a critically coupled circuit.

4. Align double-tuned circuits by adjusting their coupling from slight overcoupling toward critical coupling. You should observe slight overcoupling during the alignment process.

5. Higher insertion loss accompanies narrower bandwidths. A reasonable limit for the double-tuned circuit is $Q_0 > 2.5$.

All of the concepts governing the double-tuned circuit may be extended to filters of other orders. For example, a single-tuned circuit has an insertion loss related to bandwidth and unloaded Q. Similar relations exist for filters consisting of multiple coupled resonators. Crystal filters, arrays of dielectric resonators, and coupled microstrip sections all behave similarly. They can all be tuned with these methods.

Notes

[1]W. Hayward and D. DeMaw, *Solid-State Design for the Radio Amateur*, Appendix 2, "Band-pass filters," p 239 (Newington: ARRL, 1986). Also see W. Sabin, "Designing Narrow Band-Pass Filters with a BASIC Program," *QST*, May 1983, pp 23-29.

[2]Insertion loss (dB) = $20 \log (Q_0 / (Q_0 - 1.414))$

New Books

SHORTWAVE LISTENING GUIDEBOOK

By Harry L. Helms, AA6FW. Published by HighText Publications Inc, 7128 Miramar Rd, Suite 15, San Diego, CA 92121. First edition, 1991. Softcover, 6 × 9 inches, 320 pp, $16.95 plus shipping (and sales tax, if applicable).

Reviewed by Robert J. Halprin, K1XA
ARRL Contributing Editor

Astonishing changes swept the planet as the 1980s came to a close and the new decade commenced. Operation Desert Storm sparked a tremendous surge in shortwave listening (SWLing) among newcomers and lapsed shortwave listeners (SWLs), like many other radio amateurs. Helms' book on SWLing is a handy reference, and the writing style is clear, direct and in plain language.

With 11 chapters and six appendixes, the book is loaded with practical info for anyone who owns or is thinking of buying a shortwave receiver (or perhaps someone on the verge of making the move from an SWL to a shortwave DXer).

In its 320 pages you'll encounter everything from finding the so-called easy-listening shortwave powerhouses such as the BBC and Radio Moscow, to the challenge of logging the obscure domestic (ie, internal) services like Radio Botswana or Radio One in Singapore. The *Shortwave Listening Guidebook* addresses broadcast band, TV and FM DXing, utility stations (did you know that Interpol handles traffic on 10-MHz CW?) and ham radio.

Drawing on his experience as the Thoughts and Ideas columnist for *Popular Communications* magazine, Helms has created a working tool for getting the most out of shortwave radio, and as such, this volume deserves to be kept in readiness next to your receiver. As he covers the entire waterfront of SWLing, Helms provides the basic, jargon-free principles of emission modes, propagation and antenna theory (supplemented by professionally crafted drawings and diagrams) and conducts a guided tour of the shortwave-frequency subbands with frequency tables and such. He even tells you how to solder the connections on your shortwave dipole. In what seems like a bonus feature, he provides a riveting chapter on clandestine and pirate stations, including the "numbers stations," mysterious female voices reading—in Spanish or English—numbers of four or five digits, believed by some people to be coded instructions for espionage agents around the world. Helms resists the temptation to lapse into radio lingo and technical mumbo-jumbo—things that often afflict similar works. He has a gift for finding the right verb or adjective in his narrative, and his sense of humor and enthusiasm for radio is evident throughout.

Helms is a hands-on radio aficionado. Cards from his own QSL collection are shown throughout the book (he explains QSLing for the SWL, by the way), as are anecdotes from his listening activities. These include the post-*glasnost* Radio Moscow disk jockey advising listeners to "party hearty," hearing a brave radio announcer on Radio Beijing condemning the government immediately following the Tienanmen Square massacre, relying on the BBC (not Radio Moscow) for the first news of the Chernobyl nuclear disaster while he was on a tour of the Soviet Union in April 1986, hearing Gene Autry records played by a station in Uganda or listening to a Radio France Internationale newscaster get upset on the air after misplacing his script. Helms admits that the "magic box" of shortwave radio keeps him coming back for more, even after 25 years of dial twisting.

The author's interest in SWLing facilitated a transition into Amateur Radio. As Helms writes in the book's preface, "My desire to know more about how my shortwave radio worked pushed me into obtaining my own ham radio license and later into a career as a writer and editor of books on electronics and computing."

Helms devotes a significant portion of one chapter to ham radio and offers a balanced portrayal of our hobby: "Hams are drawn from the entire human spectrum, meaning they're just as interesting or boring as any other segment of the general population. . . some hams seem unable to converse on any other topic other than the weather or the equipment they are using (and that suits like-minded hams just fine), while others have interesting experiences to share."

Helms captures the essence of ham radio and the opportunity for personal achievement through individual initiative. He also furnishes a table of the amateur frequency bands.

If you know of someone who's been caught up in the fascination with the "magic box," but isn't quite ready for immersion in the ARRL's *Now You're Talking!: Discover the World of Ham Radio*, the *Shortwave Listening Guidebook* could be just the thing to inspire his or her imagination!