LF/MF Antennas for Amateurs

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Preface

Vertical transmitting antennas have been used since the beginning of radio. With well over 100 years of experience, literally thousands of articles and hundreds of books you would think there would be very little left to discover. However, when I began researching the literature I found continuous repetition of the same basic information but not so much on fine details, especially over the last 40 years or so. Useful information current at earlier times has often been dropped or forgotten. In a few cases I felt some of the accepted "common knowledge", much of it derived from broadcast applications, was not correct or at least not appropriate for amateur applications. In particular HF ground system design and the significant differences between HF and LF-MF soil electrical characteristics has not been adequately aired. I admit to a passion for fine details bordering on obsession but in the case of vertical antennas at least some details can be of practical help.

Sixty plus years ago Tom Erdmann, W7DND (SK), gave me some advice on priorities for my first station: if I had a $100 I should spend $90 on the antenna, $9 on the receiver and $1 for the transmitter. Prices have gone up a bit in the past 65 years but I still keep Tom's priorities firmly in mind. I've always invested far more time, money and effort in my antennas than the rest of the station. Antennas are a lot fun and in retirement LF, MF and HF verticals have become an obsession. For the past 25 years I've been particularly interested in 160m operation, building a number of vertical and sloper arrays. For the last 10 years I've been part of the ARRL 600m experimental group (WD2XSH) transmitting at 465-510 kHz. At the 2012 WRC amateurs succeeded in obtaining worldwide allocations on 2200m and 630m and the FCC has now given U.S. amateurs access to these bands.

For many years amateurs have had only one MF band, 1.80-2.0 MHz (160m) but now 135.7-137.8 kHz (2200m) and 472-479 kHz (630m) has been added. Except for a few experimental licenses amateurs haven't been allowed on these frequencies for over 100 years. This lack of experience means there is a need for practical information on many subjects related to LF/MF operation including antennas. There are many "old" but potentially useful ideas which deserve renewed consideration.

Because of the vast literature on vertical antennas I've made no attempt to make this book a compendium, it is just "some notes", nothing more. I've focused on subjects of interest to me and have direct experience with. Some of the material in this book is original but most is drawn from the work of others which I acknowledge whenever I can identify the source. The references have been placed at the end of each chapter.

It's my personal philosophy that one needs both theory and experiment to understand a phenomenon. In particular theory and experiment must give the same answer, if not then you don't understand what's going on and need to keep working to resolve the differences! I have spent many hours wondering "what the h... is going on?"

Because I'm speaking to a audience with a very wide range of experience, from the non-technical newcomer to the graduate engineer, the arrangement of this book has to be a little different. I've divided the material into two levels. The six chapters in the body of the book are limited to basic information which, combined with a little modeling or simple calculations, can be applied directly using graphs for special problems like inductor design. The math has been minimized. For those more mathematically proficient and wanting more detailed justification for the advice given in the main text, an extensive body of technical information has been placed in a series of appendices which are available on-line (tbd).

While this book is far from perfect or complete I hope it's useful.

GL and 73, Rudy Severns N6LF, WD2XSH/20 April 2017

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