

Radio Communication Handbook

ELEVENTH EDITION

Editors
Mike Dennison, G3XDV
John Fielding, ZS5JF



Radio Society of Great Britain

Published by the Radio Society of Great Britain, 3 Abbey Court, Fraser Road, Priory Business Park, Bedford.
MK44 3WH. Tel 01234 832700. Web www.rsgb.org

First published 2011.

© Radio Society of Great Britain, 2011. All rights reserved. No part of this publication may be reproduced, stored in a retrieval system, or transmitted, in any form or by any means, electronic, mechanical, photocopying, recording or otherwise, without the prior written permission of the Radio Society of Great Britain.

Cover design: Kim Meyern

Production: Mark Allgar, M1MPA

Design and layout: Mike Dennison, G3XDV, Emdee Publishing

Printed in Great Britain by Latimer Trend of Plymouth

Companion CD printed by DBMasters of Faversham, England (www.dbmasters.co.uk)

The opinions expressed in this book are those of the author(s) and are not necessarily those of the Radio Society of Great Britain. Whilst the information presented is believed to be correct, the publishers and their agents cannot accept responsibility for consequences arising from any inaccuracies or omissions.

ISBN 9781-9050-8674-1

Acknowledgements

The principal contributors to this book were:

| | | |
|-------------|--|--|
| Chapter 1: | Principles | Alan Betts, G0HIQ |
| Chapter 2: | Passive components | 'Phosphor' Stuart Swain, G0FYX |
| Chapter 3: | Semiconductors and valves | Alan Betts, G0HIQ Fred Ruddell, G14MWA |
| Chapter 4: | Building blocks 1: Oscillators | Peter Goodson, G4PCF |
| Chapter 5: | Building blocks 2: Amplifiers, mixers etc | Peter Goodson, G4PCF |
| Chapter 6: | HF receivers | Roger Wilkins, G8NHG |
| Chapter 7: | HF transmitters and transceivers | Bill Mantovani, G4ZVB Peter Hart, G3SJX Andy Talbot, G4JNT |
| Chapter 8: | Software defined radio | Steve Ireland, VK6VZ Phil Harman, VK6APH |
| Chapter 9: | VHF/UHF receivers, transmitters and transceivers | Andy Barter, G8ATD |
| Chapter 10: | Low frequencies: Below 1MHz | Jim Moritz, M0BMU |
| Chapter 11: | Practical microwave receivers and transmitters | Andy Barter, G8ATD Stuart Wisher, G8CYW |
| Chapter 12: | Propagation | Gwyn Willams, G4FKH |
| Chapter 13: | Antenna basics and construction | Peter Dodd, G3LDO |
| Chapter 14: | Transmission lines | Peter Dodd, G3LDO |
| Chapter 15: | Practical HF antennas | Peter Dodd, G3LDO |
| Chapter 16: | Practical VHF/UHF antennas | Peter Swallow, G8EZE |
| Chapter 17: | Practical microwave antennas | Andy Barter, G8ATD |
| Chapter 18: | The great outdoors | Richard Marshall, G4ERP |
| Chapter 19: | Morse code | Roger Cooke, G3LDI |
| Chapter 20: | Data communications | Andy Talbot, G4JNT |
| Chapter 21: | Computers in the shack | Andy Talbot, G4JNT |
| Chapter 22: | Electromagnetic compatibility | Robin Page-Jones, G3JWI |
| Chapter 23: | Power supplies | 'Phosphor' John Fielding, ZS5JF |
| Chapter 24: | Measurement and test equipment | Clive Smith, GM4FZH |
| Chapter 25: | Construction and workshop practice | Eamon Skelton, EI9GQ |

Thanks also go to the contributors to previous editions of this book and the authors of the published *RadCom* articles which provided some of the source material.

Contents

| | |
|--|--------------|
| Acknowledgements | .iii |
| Preface | .vii |
| Chapter 1: Principles | .1.1 |
| Chapter 2: Passive components | .2.1 |
| Chapter 3: Semiconductors and valves | .3.1 |
| Chapter 4: Building blocks 1: Oscillators | .4.1 |
| Chapter 5: Building blocks 2: Amplifiers, mixers etc | .5.1 |
| Chapter 6: HF receivers | .6.1 |
| Chapter 7: HF transmitters and transceivers | .7.1 |
| Chapter 8: Software defined radio | .8.1 |
| Chapter 9: VHF/UHF receivers, transmitters and transceivers | .9.1 |
| Chapter 10: Low frequencies: Below 1MHz | .10.1 |
| Chapter 11: Practical microwave receivers and transmitters | .11.1 |
| Chapter 12: Propagation | .12.1 |
| Chapter 13: Antenna basics and construction | .13.1 |
| Chapter 14: Transmission lines | .14.1 |
| Chapter 15: Practical HF antennas | .15.1 |
| Chapter 16: Practical VHF/UHF antennas | .16.1 |
| Chapter 17: Practical microwave antennas | .17.1 |
| Chapter 18: The great outdoors | .18.1 |
| Chapter 19: Morse code | .19.1 |
| Chapter 20: Digital communications | .20.1 |
| Chapter 21: Computers in the shack | .21.1 |
| Chapter 22: Electromagnetic compatibility | .22.1 |
| Chapter 23: Power supplies | .23.1 |
| Chapter 24: Measurement and test equipment | .24.1 |
| Chapter 25: Construction and workshop practice | .25.1 |
| Appendix A: General data | .A.1 |
| Appendix B: Printed circuit board artwork | .B.1 |
| Index | .ix |

Note: Many chapters have references to the RSGB Bulletin, Radio Communication or RadCom. These are historic names of the RSGB members' monthly journal. The magazines are available on a series of CD-ROMs from: RSGB, 3 Abbey Court, Fraser Road, Priory Business Park, Bedford. MK44 3WH (www.rsgb.org)

Preface

Congratulations on buying the 11th edition of the *Radio Communication Handbook*. If it is your first *Handbook*, you will be amazed at the wealth of information contained in it. Those of you who have bought earlier editions will notice the many updates and amendments.

Among the updates to this edition are details of experiments taking place at the extremes of the radio spectrum. At the low end, amateur transmissions below 10kHz have been received over hundreds of kilometres, and at the high end SSB has been transmitted using light waves. This book gives full details of the equipment used, so that anyone equipped with a suitable permit (in the case of VLF) and a spirit of adventure can join in. This is the very essence of amateur radio.

More down to earth additions include a digital upconverter, modern battery technologies, noise cancelling, oscillator noise, receiver measurements, propagation prediction software, mobile phone apps, new digital modes, PIC projects, and much more.

Extra pages have been allocated to the chapters on Mixers/Amps/Filters, HF Receivers, HF Transmitters, Low Frequencies, Microwave Transmitters/Receivers, VHF/UHF Antennas, The Great Outdoors and Computers in the Shack.

Of course the bedrock of the *Handbook* is the vast amount of basic information, richly illustrated by many drawings and photographs, and written by experts on each topic. Keep this book handy at all times - you will want to refer to it constantly.

As usual, a CD is supplied free with the *Handbook*, and it is packed with goodies. In addition to a fully searchable electronic version of this book, there are extra chapters and articles, video and audio files linked to the SDR chapter, and a wealth of free software which we think will be useful to you.

Thanks go to the 23 authors who have contributed their expertise and those who have suggested ideas since the last edition. We are always looking for ways to improve the *Handbook*, so if you have any comments or suggestions, please write to the Radio Communication Editor c/o RSGB.

Mike Dennison, G3XDV

John Fielding, ZS5JF

