

- Foreword p. xi
- Preface p. xiii
- Part 1 Introduction
  - 1 Introduction to radio frequencies p. 3
  - What are the 'radio frequencies'? p. 3
  - Why are radio frequencies different? p. 3
  - What this book covers p. 3
- 2 Signals and noise p. 5
  - Types of signals p. 5
  - Fourier series p. 9
  - Waveform symmetry p. 11
  - Transient signals p. 17
  - Sampled signals p. 18
  - Noise p. 21
  - Signal-to-noise ratio (SNR or S<sub>n</sub>) p. 27
  - Noise factor, noise figure and noise temperature p. 29
  - Noise in cascade amplifiers p. 31
  - Noise reduction strategies p. 31
  - Noise reduction by signal averaging p. 32
- 3 Radio receivers p. 34
  - Signals, noise and reception p. 34
  - The reception problem p. 35
  - Strategies p. 37
  - Radio receiver specifications p. 38
  - Origins p. 38
  - Superheterodyne receivers p. 39
  - Receiver performance factors p. 44
  - Units of measure p. 45
  - Noise p. 46
  - Signal-to-noise ratio (SNR or S<sub>n</sub>) p. 46
  - Receiver noise floor p. 47
  - Static measures of receiver performance p. 47
  - Sensitivity p. 47
  - Selectivity p. 50
  - Stability p. 57
  - AGC range and threshold p. 58
  - Dynamic performance p. 58
  - Intermodulation products p. 59
  - -1 dB compression point p. 60
  - Third-order intercept point p. 60
  - Dynamic range p. 62
  - Blocking p. 63
  - Cross-modulation p. 63
  - Reciprocal mixing p. 64
  - IF notch rejection p. 64
  - Internal spuri p. 65

- Part 2 Circuits
- 4 RF amplifiers p. 69
- Noise and preselectors/preamplifiers p. 70
- Amplifier configurations p. 70
- Transistor gain p. 70
- Classification by common element p. 72
- Transistor biasing p. 73
- Frequency characteristics p. 75
- JFET and MOSFET connections p. 75
- JFET preselector p. 76
- VHF receiver preselector p. 79
- MOSFET preselector p. 81
- Voltage-tuned receiver preselector p. 81
- Broadband RF preamplifier for VLF, LF and AM BCB p. 81
- Push-pull RF amplifiers p. 84
- Broadband RF amplifier (50 ohm input and output) p. 89
- 5 Mixers p. 91
- Linear-vs-non-linear mixers p. 91
- Simple diode mixer p. 94
- The question of 'balance' p. 95
- Spurious responses p. 95
- Mixer distortion products p. 98
- Third-order intercept point p. 99
- Calculating intercept points p. 101
- Mixer losses p. 101
- Noise figure p. 102
- Noise balance p. 102
- Single-ended active mixer circuits p. 103
- Balanced active mixers p. 104
- Gilbert cell mixers p. 113
- Passive double-balanced mixers p. 114
- Diplexers p. 116
- Bandpass diplexers p. 117
- Double DBM p. 122
- Image reject mixers p. 122
- VHF/UHF microwave mixer circuits p. 124
- 6 Oscillators p. 124
- Feedback oscillators p. 124
- General types of RF oscillator circuits p. 126
- Piezoelectric crystals p. 128
- Temperature performance p. 133
- Miller oscillators p. 134
- Pierce oscillators p. 136
- Butler oscillators p. 138
- Colpitts oscillators p. 143
- Overtone oscillators p. 145

- Frequency stability p. 147
- Temperature p. 149
- Other stability criteria p. 150
- Frequency synthesizers p. 157
- 7 IF amplifiers and filters p. 161
- IF filters: general filter theory p. 161
- L-C IF filters p. 163
- Crystal filters p. 165
- Crystal ladder filters p. 167
- Monolithic ceramic crystal filters p. 170
- Mechanical filters p. 170
- Saw filters p. 171
- Filter switching in IF amplifiers p. 172
- Amplifier circuits p. 173
- Cascode pair amplifier p. 175
- 'Universal' IF amplifier p. 175
- Coupling to block filters p. 178
- More IC IF amplifiers p. 179
- FM IF amplifier p. 180
- Successive detection logarithmic amplifiers p. 180
- 8 Demodulators p. 185
  - AM envelope detectors p. 185
  - AM noise p. 190
  - Synchronous AM demodulation p. 190
  - Double sideband (DSBSC) and single sideband (SSBSC) suppressed carrier demodulators p. 190
- Phasing method p. 197
- FM and PM demodulator circuits p. 197
- Foster-Seeley discriminator p. 197
- Ratio detector p. 200
- Pulse counting detector p. 204
- Phase-locked loop FM/PM detectors p. 206
- Quadrature detector p. 206
- Part 3 Components
- 9 Capacitors p. 209
  - Units of capacitance p. 209
  - Breakdown voltage p. 211
  - Circuit symbols for capacitors p. 211
  - Fixed capacitors p. 212
  - Paper dielectric capacitors p. 212
  - Mylar dielectric capacitors p. 212
  - Ceramic dielectric capacitors p. 213
  - Mica dielectric capacitors p. 214
  - Other capacitors p. 214
  - Variable capacitors p. 215
  - Air variable main tuning capacitors p. 217

- Capacitor tuning laws - SLC-vs-SLF p. 219
- Special variable capacitors p. 220
- Variable capacitor cleaning note p. 222
- Using and stabilizing a varactor diode p. 223
- Varactor tuning circuits p. 223
- Temperature compensation p. 228
- Varactor applications p. 230
- 10 Inductors p. 232
- Inductor circuit symbols p. 232
- Inductance and inductors p. 233
- Inductance of a single straight wire p. 234
- Combining two or more inductors p. 235
- Air-core inductors p. 236
- Solenoid wound air-core inductors p. 237
- Adjustable coils p. 237
- Winding your own coils p. 239
- Amidon Associates coil system p. 239
- Using ferrite and powdered iron cores p. 240
- Materials used in cores p. 240
- Powdered iron p. 241
- Ferrite materials p. 242
- Making the calculations p. 242
- Toroid cores p. 244
- Inductors and transformers p. 247
- Winding toroid cores p. 251
- Mounting toroids p. 254
- High-power transformers p. 257
- Binocular cores p. 257
- Ferrite rods p. 261
- Bobbing along with a bobbin p. 263
- Ferrite beads p. 264
- 11 Tuning and matching p. 267
- Vectors for RF circuits p. 267
- L-C resonant tank circuits p. 270
- Tuned RF/IF transformers p. 273
- Construction of RF/IF transformers p. 274
- Bandwidth of RF/IF transformers p. 276
- Choosing component values for L-C resonant tank circuits p. 279
- The tracking problem p. 281
- The RF amplifier/antenna tuner problem p. 281
- The local oscillator (LO) problem p. 283
- Trimmer capacitor method p. 284
- Impedance matching in RF circuits p. 285
- Transformer matching p. 286
- Resonant transformers p. 287
- Resonant networks p. 288

- Inverse-L network p. 289
- [pi]-network p. 289
- Split-capacitor network p. 290
- Transistor-to-transistor impedance matching p. 291
- 12 Splitters and hybrids p. 293
- RF power combiners and splitters p. 293
- Characteristics of splitter/combiner circuits p. 293
- Resistive splitter/combiner p. 294
- Transformer splitter/combiner p. 295
- How it works p. 298
- Modified VSWR bridge splitter/combiner p. 299
- 90 degree splitter/combiner p. 301
- Transmission line splitter/combiners p. 301
- 90 degree transmission line splitter/combiner p. 303
- Hybrid ring 'rat race' network p. 304
- RF hybrid couplers p. 305
- Applications of hybrids p. 306
- Combining signal sources p. 306
- Bi-directional amplifiers p. 307
- Transmitter/receiver isolation p. 307
- Quadrature hybrids p. 309
- RF directional couplers p. 312
- Conclusion p. 316
- 13 Monolithic microwave integrated circuits p. 317
- Internal circuitry p. 319
- Basic amplifier circuit p. 320
- Other MAR-x circuits p. 321
- Multiple device circuits p. 327
- Mast-mounted wideband preamplifier p. 333
- Broadband HF amplifier p. 333
- Part 4 Measurement and techniques
- 14 Measuring inductors and capacitors p. 337
- VSWR method p. 337
- Voltage divider method p. 337
- Signal generator method p. 339
- Frequency shifted oscillator method p. 340
- Using RF bridges p. 342
- Finding parasitic capacitances and inductances p. 344
- Conclusion p. 350
- 15 RF power measurement p. 351
- Power units p. 351
- Types of RF power measurement p. 351
- Methods for measuring RF power p. 352
- Thermistor RF power meters p. 352
- Diode detector RF power meters p. 358
- Practical in-line bridge circuits p. 360

- The Bird Thruline sensor p. 364
- Calorimeters p. 366
- Micropower and low power measurements p. 370
- Error and uncertainty sources p. 372
- 16 Filtering against EMI/RFI p. 374
  - Shielding p. 374
  - Filter circuits p. 374
- R-C EMI/RFI protection p. 376
- Feedthrough capacitors p. 377
- General guidelines p. 380
- 17 Noise cancellation bridges p. 381
  - A simple bridge circuit p. 383
- Bibliography p. 388
- Index p. 391