

Supplemental Files – 2017 ARRL Handbook

Supplemental files are included on the CD-ROM. They include additional discussion, related articles, additional projects, full-size PC board etching patterns and templates, program examples, construction details and other useful information. All of these packages are available on this CD-ROM in the **Supplemental Files** directory and then organized by chapter. (Note: Chapters 1 and 8 have no supplemental files.)

Chapter 2

Supplemental Articles

- “Radio Mathematics” — supplemental information about math used in radio and a list of online resources and tutorials about common mathematics
- “Hands-On Radio: Kirchoff’s Laws” by Ward Silver, NØAX
- “Hands-On Radio: Laying Down the Laws” by Ward Silver, NØAX
- “Hands-On Radio: Putting the Laws to Work” by Ward Silver, NØAX
- “Hands-On Radio: Thevenin Equivalents” by Ward Silver, NØAX
- “A Tutorial on the Decibel” by Ward Silver, NØAX

Projects

- “Thermistors in Homebrew Projects” by Bill Sabin, WØIYH
- “Thermistor Based Temperature Controller” by Bill Sabin, WØIYH

Chapter 3

Supplemental Articles

- “Hands-On Radio: The Common Emitter Amplifier” by Ward Silver, NØAX
- “Hands-On Radio: The Emitter-Follower Amplifier” by Ward Silver, NØAX
- “Hands-On Radio: The Common Base Amplifier” by Ward Silver, NØAX
- “Hands-On Radio: Field Effect Transistors” by Ward Silver, NØAX
- “Hands-On Radio: Basic Operational Amplifiers” by Ward Silver, NØAX
- “Hands-On Radio: Load Lines” by Ward Silver, NØAX
- “Hands-On Radio: The Effects of Gain-Bandwidth Product” by Ward Silver, NØAX
- Cathode Ray Tubes
- Large Signal Transistor Operation

Tools and Data

- *LTSpice* Simulation Files for Chapter 3
- Frequency Response Spreadsheet

Chapter 4

Supplemental Articles

- “Interfacing to the Parallel Port” and supporting files by Paul Danzer, N1II
- “Learning to PIC with a PIC-EL” (Parts 1 and 2) by Craig Johnson, AAØZZ
- “Pickle with USB I/O” by Craig Johnson, AAØZZ

Chapter 5

Supplemental Articles

- “Reflections on the Smith Chart” by Wes Hayward, W7ZOI
- Tuned Networks
- “Simplified Design of Impedance-Matching Networks,” Parts I through III
by George Grammer, W1DF (SK)
- *LTSpice* simulation files for Section 5.3, Effects of Parasitic Characteristics
- “Noise Instrumentation and Measurement” by Paul Wade, W1GHZ

Chapter 6

Supplemental Articles

- “The Dangers of Simple Usage of Microwave Software” by Ulrich Rohde, N1UL
and Hans Hartnagel
- “Using Simulation at RF” by Ulrich Rohde, N1UL
- “Mathematical Stability Problems in Modern Non-Linear Simulation Programs”
by Ulrich Rohde, N1UL and Rucha Lakhe
- Examples of Circuit Simulation by David Newkirk, W9VES

Chapter 7

Projects

- Four Output Bench Supply
- 12 V 15 A Power Supply — Article and PCB Template
- 13.8 V 5 A Power Supply — PCB Template
- 28 V High Current Power Supply — Article and PCB Template
- Dual Output Power Supply
- Micro M+ PV Charge Controller
- Revisiting the 12 V Power Supply
- Series Regulator Power Supply — Article and PCB Template
- Build an Inverting DC-DC Converter
- “Simple Adjustable Tracking Power Supply” by Bryant Julstrom, KCØZNG
- “A Deluxe High Voltage Supply” by James Garland, W8ZR

Supplemental Articles

- Testing and Monitoring Batteries — Excerpts from *Batteries in a Portable World* by Isidor Buchmann
- Vacuum Tube and Obsolete Rectifiers

Chapter 9

Supplemental Files

- Measuring Receiver Phase Noise
- “Oscillator Design Using *LTSpice*” by David Stockton, GM4ZNX
(includes *LTSpice* simulation files in SwissRoll folder)
- Using the MC1648 in Oscillators
- “Novel Grounded Base Oscillator Design for VHF-UHF” by Dr Ulrich Rohde, N1UL
- “Optimized Oscillator Design” by Dr Ulrich Rohde, N1UL
- “Oscillator Phase Noise” by Dr Ulrich Rohde, N1UL
- “Some Thoughts On Crystal Oscillator Design” by Dr Ulrich Rohde, N1UL
- “Calculation of FM and AM Noise Signals of Colpitts Oscillators in the Time Domain” by Dr Ulrich Rohde, N1UL

- “Some Thoughts on Designing Very High Performance VHF Oscillators”
by Dr Ulrich Rohde, N1UL
- “What You Always Wanted to Know About Colpitts Oscillators”
by Dr Ulrich Rohde, N1UL, and Anisha M. Apt

Chapter 10

Supplemental Articles

- “Modern Receiver Mixers for High Dynamic Range” by Doug DeMaw, W1FB (SK)
and George Collins, KC1V
- “Performance Capability Of Active Mixers” by Dr Ulrich Rohde, N1UL

Chapter 11

Supplemental Articles

- “Using Active Filter Design Tools” by Dan Tayloe, N7VE
- “Crystal Parameter Measurements Simplified”, by Chuck Adams, K7QO

Projects

- “An Easy-to-Build, High-Performance Passive CW Filter” by Ed Wetherhold, W3NQN
- “A High Performance, Low Cost 1.8 to 54 MHz Low Pass Filter” by Bill Jones, K8CU

Chapter 12

Supplemental Files

- “Amateur Radio Equipment Development — An Historical Perspective”
by Joel Hallas, W1ZR
- “A Dual Band Low Noise Amplifier for 2 Meters and 70 Centimeters”
by Jim Kocsis, WA9PYH
- “A High Performance 45 MHz IF Amplifier” by Colin Horrabin, G3SBI

Project Files

- Rock Bending Receiver PCB template by Randy Henderson, WI5W
- 10 GHz preamp PCB template by Zack Lau, W1VT
- Binaural Receiver project by Rick Campbell, KK7B

Chapter 13

Supplemental Articles and Projects

- “Designing and Building Transistor Linear Power Amplifiers” Parts 1 and 2
by Rick Campbell, KK7B
- “A Fast TR Switch” by Jack Kuecken, KE2QJ
- “A Homebrew High Performance HF Transceiver — the HBR-2000”
by Markus Hansen, VE7CA
- “The MicroT2 — A Compact Single-Band SSB Transmitter” by Rick Campbell, KK7B
- “The MkII — An Updated Universal QRP Transmitter” by Wes Hayward, W7ZOI
- “The Norcal Sierra: An 80-15 M CW Transceiver” by Wayne Burdick, N6KR
(plus supporting files)
- “The Rockmite — A Simple Single-Band CW Transceiver” by Dave Benson, K1SWL
(plus supporting files)
- “The TAK-40 SSB/CW Transceiver” by Jim Veatch, WA2EUJ
- “A Transmitter for Fox Hunting” by Mark Spencer, WA8SME
- “The Tuna Tin 2 Today” by Ed Hare, W1RFI
- “VHF Open Sources” by Rick Campbell, KK7B (plus parts placement guides)
- “A Microwave Controller” by Hamish Kellock, OH2GAQ
- “A 50 MHz CW Beacon” and “50 MHz Parts List” by Michael Sapp, WA3TTS
- “VHF and UHF CW Beacons” by Michael Sapp, WA3TTS
- “A West Coast Lightwave Project” by Steve McDonald, VE7SL, and
Markus Hansen, VE7CA

Chapter 14

Supplemental Articles

- “A Simple Sensor Package for High Altitude Ballooning” by John Post, KA5GSQ
- “APRS Unveiled” by Bob Simmons, WB6EYV
- “APRS with a Smartphone” by Pat Cain, KØPC
- “ARRL Education and Technology Program Space/Sea Buoy”
by Mark Spencer, WA8SME
- “Touching Near Space on a Budget” by Paul Verhage, KD4STH
- Collection of Powerpoint presentations and PDF articles by Paul Verhage, KD4STH,
on high-altitude platforms, including BalloonSat construction and testing
- “Fox-1 Satellite Telemetry – Part 1: On the Satellite,” by Burns Fisher, W2BFJ
- “Fox-1 Satellite Telemetry – Part 2: FoxTelem,” by Chris Thompson, AC2CZ

Chapter 15

- A collection of DSP projects with supporting files
- A discussion of DSP calculations with samples and files that
accompany the discussion

Chapter 16

Supplemental Files

- Table of digital mode characteristics (section 16.6)
- ASCII and ITA2 code tables
- Varicode tables for PSK31, MFSK16 and DominoEX
- “Operating Tips for Digital Voice Using *FreeDV*” by Mel Whitten, KØPFX
- Digital Modes - Lowest Permitted Amateur Frequency

Chapter 17

Supplemental Articles

- Tuned (Resonant) Networks (for use with MATCH.EXE)
- Design Example — RF Amplifier using 8877 Vacuum Tube by John Stanley, K4ERO
- Design Example — MOSFET Thermal Design by Dick Frey, K4XU
- Determining a Transistor's Power Rating (APT Application Note) by Dick Frey, K4XU
- *ARRL RF Amplifier Classics* Table of Contents

HF Amplifier Projects

- “The Everyham’s Amp” by John Stanley, K4ERO
- Everyham’s Amp files — construction notes, layouts, modifications for various tube types
- “A 3CX1500D7 RF Linear Amplifier” by Jerry Pittenger, K8RA
- 3CX1500D7 HF amplifier files — PCB layout, Pi-L values spreadsheet
- “A 250 W Broadband Solid-State Linear Amplifier” by Dick Frey, K4XU
- 250 W solid state amplifier files — PCB artwork, parts lists, photos (including updated PCB and schematic files, Mar 2013)
- “The Sunnyvale/Saint Petersburg Kilowatt-Plus,” a 4CX1600B HF amplifier project by George Daughters, K6GT

VHF Amplifier Projects

- “A 6 Meter Kilowatt Amplifier” by Dick Stevens, W1QWJ (SK)
- “144 MHz Amplifier Using the 3CX1200Z7” by Russ Miller, N7ART
- “Build a Linear 2 Meter, 80 W All Mode Amplifier” by James Klitzing, W6PQL
- “Design Notes for ‘A Luxury Linear’ Amplifier” by Mark Mandelkern, K5AM
- “High-Performance Grounded-Grid 220-MHz Kilowatt Linear”
by Robert Sutherland, W6PO (SK)

UHF/Microwave Amplifier Projects

- “432 MHz 3CX800A7 Amplifier” by Steve Powlishen, K1FO (SK)
- “A High-Power Cavity Amplifier for the New 900-MHz Band”
by Robert Sutherland, W6PO (SK)
- “A Quarter-Kilowatt 23-cm Amplifier” by Chip Angle, N6CA
- “2 Watt RF Power Amplifier for 10 GHz” by Steven Lampereur, KB9MWR

Chapter 18

Supplemental Articles

- “From Analog to D-STAR” by Gary Pearce, KN4AQ
- “Discovering D-STAR” by Larry Moxon, K1KRC
- “D-STAR Uncovered” by Pete Loveall, AE5PL
- “Operating D-STAR” by Gary Pearce, KN4AQ

Chapter 19

Supplemental Articles

- “The Penticton Solar Flux Receiver,” by John White, VA7JW and Ken Tapping
- “Hands-On Radio: Recording Signals”, W Silver, NØAX

Projects

- “Build a Homebrew Radio Telescope”, M Spencer, WA8SME

Chapter 20

Supplemental Articles

- “Multiband Operation with Open-wire Line” by George Cutsogorge, W2VJN
- Smith Chart Supplement
- “Measuring Receiver Isolation” by George Cutsogorge, W2VJN
- “A Commercial Triplexer Design” by George Cutsogorge, W2VJN
- “HF Yagi Triplexer Especially for ARRL Field Day” by Gary Gordon, K6KV
- “Using *TLW* to Design Impedance Matching Networks”
by George Cutsogorge, W2VJN
- “Measuring Ferrite Chokes” by Jim Brown, K9YC
- “Microwave Plumbing” by Paul Wade, W1GHZ
- Transmission Lines in Digital Circuits
- Matching network material and MATCH.EXE by Bill Sabin, WØIYH
- “Optimizing the Placement of Stubs for Harmonic Suppression” by Jim Brown, K9YC
- “Optimizing the Performance of Harmonic Attenuation Stubs”
by George Cutsogorge, W2VJN

Chapter 21

Supplemental Articles

- “Direction Finding Techniques” by Joe Moell, KØOV

Projects

- “Rotatable Dipole Inverted-U Antenna” by L.B. Cebik, W4RNL
- Construction details for “Top-Loaded Low-Band Antenna” by Dick Stroud, W9SR
- “Five-Band Two-Element Quad” by Al Doig, W6NBH, and William Stein, KC6T
- “Medium-Gain 2 Meter Yagi” by L.B. Cebik, W4RNL
- “K8SYL's 75 and 10-Meter Dipole” by Sylvia Hutchinson, K8SYL
- “A Plumber’s Delight for 2 Meters — An All-Copper J-Pole” by Michael Hood, KD8JB
- “Cheap Antennas for the AMSAT LEOs” by Kent Britain, WA5VJB
- “Wire Quad for 40 Meters” by Dean Straw, N6BV
- “Vertical Loop Antenna for 28 MHz”
- “Dual-Band Antenna for 146/446 MHz” by Wayde Bartholomew, K3MF
- “The TriMox — A Moxon Tribander for a Holiday DXpedition” by
Brian Machesney, K1LI
- “A Simple Fixed Antenna for VHF/UHF Satellite Work,” by L. B. Cebik, W4RNL
- “Having a Field Day with the Moxon Rectangle,” by L. B. Cebik, W4RNL
- “Extended Double-Zepp for 17 Meters” from 2016 Handbook
- Triband Dipole for 30, 17, and 12 Meters” by Zack Lau W1VT
- “A Compact Multiband Dipole” by Zack Lau W1VT

Chapter 22

Supplemental Files

- BNC Crimp Installation Instructions
- N Crimp Installation Instructions
- Miniature Lamp Guide
- Thermoplastics Properties
- TV Deflection Tube Guide
- Obsolete RF Power Semiconductor Tables

Chapter 23

Supplemental Files

- “A No-Special-Tools SMD Desoldering Technique” by Wayne Yoshida, KH6WZ
- “Surface Mount Technology — You Can Work With It” by Sam Ulbing, N4UAU
(Parts 1 - 4)
- “A Deluxe Soldering Station”
- Making Your Own Printed Circuit Boards
- “Reflow Soldering for the Radio Amateur” by Jim Koehler, VE5JP

Chapter 24

Projects

- “A Remote Power Controller” by Mike Bryce, WB8VGE
- “A Switched Attenuator” courtesy of RSGB
- “The ID-O-Matic Station Identification Timer” by Dale Botkin, NØXAS
- “Tandem Match—Accurate Directional Wattmeter” by John Grebenkemper, KI6WX
- “Two QSK Controllers for Amplifiers” by Jim Colville, W7RY
and Paul Christensen, W9AC
- “Build a Legal Limit Bias T that Covers 1.8 to 230 MHz” by Phil Salas, AD5X
- “An Eight Channel Remote Control Antenna Selector” by Michael Dzado, ACØHB
- “Multiband Tuning Circuits” by R. W. Johnson, W6MUR
- “Adapting Aviation Headset to Ham Radio”
- “An Arduino-based Knob Box for SDR” by Michael Stott, VE3EBR
- “A Low-Cost Remote Antenna Switch” by Bill Smith, KO4NR
- “A Raspberry Pi Network Server/Client for Antenna Rotor,” by Tom Doyle, W9KE

Support Files

- Code and support files for ID-O-Matic by Dale Botkin, NØXAS
- Support files for SWR Monitor by Larry Coyle, K1QW
- Support files for “Two QSK Controllers for Amplifiers” by Jim Colville, W7RY
and Paul Christensen, W9AC
- Trio of Computer Interfaces PCB template

Chapter 25

Supplemental Files

- Cathode ray tube theory
- Test and Measurement Bibliography
- ARRL Lab Test Procedures Manual – 2010
- “Noise Instrumentation and Measurement” by Paul Wade W1GHZ

Project Files

- Gate Dip Oscillator articles and PCB artwork — Alan Bloom, N1AL
- Build a Return Loss Bridge — James Ford, N6JF
- Logic Probe — supporting photos and graphics — Alan Bloom, N1AL
- RF Power Meter — supporting files — William Kaune, W7IEQ
- Compensated RF Voltmeter articles — Sidney Cooper, K2QHE
- RF Sampler Construction details — Thomas Thompson, WØIVJ
- RF Step Attenuator — Denton Bramwell, K7OWJ
- Tandem Match articles — John Grebenkemper, KI6WX
- Transistor Tester — PCB artwork and layout graphics — Alan Bloom, N1AL
- Two-Tone Oscillator — PCB artwork and layout graphics — ARRL Lab
- “A Low Frequency Adapter for your Vector Network Analyzer (VNA)”
by Jacques Audet, VE2AZX

Chapter 26

Supplemental Articles

- “Troubleshooting Radios” by Mel Eiselman, NC4L
- “Building a Modern Signal Tracer” by Curt Terwilliger, W6XJ
- “Hands-on Radio — Power Supply Analysis” by Ward Silver, NØAX
- “Amplifier Care and Maintenance” by Ward Silver, NØAX
- “Diode and Transistor Test Circuits” by Ed Hare, W1RFI

PC Board Templates

- Crystal controlled signal source template
- AF/RF signal injector template

Chapter 27

Supplemental Files

- “What to Do if You Have an Electronic Interference Problem” — *CEA Handbook*
- TV Channel, Amateur Band and Harmonic Chart

Projects

- “A Home-made Ultrasonic Power Line Arc Detector and Project Update”
by Jim Hanson, W1TRC (SK)
- “A Simple TRF Receiver for Tracking RFI” by Rick Littlefield, K1BQT
- “Active Attenuator for VHF-FM” by Fao Eenhoorn, PAØZR (article and template)
- “Simple Seeker” by Dave Geiser, W5IXM
- “Tape Measure Beam for Power Line Hunting” by Jim Hanson, W1TRC (SK)

Chapter 28

Supplemental Files

- *Electric Current Abroad* — U.S. Dept of Commerce
- “Shop Safety” by Don Daso, K4ZA
- “RF Safety at Field Day” by Greg Lapin, N9GL
- “Field Day Tower Safety” by Don Daso, K4ZA and Ward Silver, NØAX

Chapter 29

Portable Stations

- “Product Review: A Look at Gasoline Powered Inverter Generators,”
by Bob Allison, WB1GCM
- “Field Day Tower Safety,” by Don Daso, K4ZA and Ward Silver, NØAX

Remote Stations

- “Remote Station Resources by K6VVA - 2014 Edition” —
a list of resources for remote station builders

Image Communications

- Educational robot ATV setup details (BOE-BOT project) by Mark Spencer, WA8SME