

## Supplemental Files – 2018 ARRL Handbook

Supplemental files available online 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 in the **Supplemental Files** directory and then organized by chapter. (Note: Chapter 1 has 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, plus a cheat sheet with formulas and tables
- 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
- Scientific and Engineering Notation by Walter Banzhaf, WB1ANE
- Understanding a Scientific Calculator by Walter Banzhaf, WB1ANE

### Chapter 3

#### Supplemental Articles

- Digital Electronic Basics by Dale Botkin, NØXAS
- Hands-On Radio: The Effects of Gain-Bandwidth Product by Ward Silver, NØAX
- Maxwell Without Tears by Paul Shuch, N6TX
- Radio Mathematics — included with the Chapter 2 supplemental information

#### Tools and Data

- Frequency Response Spreadsheet

## Chapter 4

### 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
- Cathode Ray Tubes
- Large Signal Transistor Operation

### Tools and Data

- *LTSpice* Simulation Files
- Frequency Response Spreadsheet

## 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

### Tools and Data

- *LTSpice* simulation files for Effects of Parasitic Characteristics

## 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
- SON and data files for the Electromagnetic Analysis of RF Circuits section
- Full color images for the Electromagnetic Analysis of RF Circuits section

## Chapter 7

### Projects

- Four Output Bench Supply — Article and support files
- 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 8

### Supplemental Files

- SDR Simplified - Fourier Transforms by Ray Mack, W5IFS
- SDR Simplified - Fundamentals of Sampling by Ray Mack, W5IFS
- SDR Simplified - More on Sampling by Ray Mack, W5IFS
- KA9Q SDR Source Code

## Chapter 9

### Supplemental Files

- Frequency Synthesis: Current and Future Projections by Alexander Chenakin
- Simulation of the Low Noise Oscillator from Solid State Design for the Radio Amateur by Linley Gumm, K7HFD
- Crystal Test Oscillators by Fred Brown, W6HPH
- 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 Files

- Using Active Filter Design Tools by Dan Tayloe, N7VE
- Crystal Parameter Measurements Simplified, by Chuck Adams, K7QO
- An Improved Audio-Frequency Bandpass Filter for Morse Code Reception  
by Jim Tonne, W4ENE
- HF Yagi Triplexer Especially for Field Day by Gary Gordon, K6KV
- 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
- Combine V.H.F. Bandpass Filters, by R. Fisher, W2CQH
- Hands-On Radio Experiments #87 and #88, *ELSIE* Filter Design — Parts 1  
and 2 by Ward Silver, NØAX
- Altoids Tin Filters by Paul Wade, W1GHZ
- 6-Meter Filter with Harmonic Suppression, by Paul Wade W1GHZ
- Combine Filters for VHF and UHF, by Paul Wade W1GHZ
- Manual Filter Design Examples by Jim Tonne, W4ENE
- Crystal Filter Design and Crystal Characterization
- SDR Simplified - Filter Design Program by Ray Mack, W5IFS
- SDR Simplified - Fourier Transforms by Ray Mack, W5IFS
- SDR Simplified - More Filter Activities by Ray Mack, W5IFS
- SDR Simplified - Cascaded Integrator Comb Filters by Ray Mack, W5IFS
- CW Waveshaping in DSP Software by Alex Shovkoplyas, VE3NEA

## Chapter 11

### Supplemental Articles

- SDR Simplified - Introduction to I and Q by Ray Mack, W5IFS
- Emissions Designator Table
- KA9Q SDR Source Code
- About SSB and About FM by Ward Silver, NØAX

## Chapter 12

### Supplemental Files

- Amateur Radio Equipment Development — An Historical Perspective  
by Joel Hallas, W1ZR
- SDR Simplified - Filter Design Program by Ray Mack, W5IFS
- SDR Simplified - Introduction to CIC Filters by Ray Mack, W5IFS
- SDR Simplified - More Filter Activities by Ray Mack, W5IFS
- SDR Simplified - Nyquist Meets Real World by Ray Mack, W5IFS
- Noise Power Ratio (NPR) Testing on HF Receivers by Adam Farson, VA7OJ/AB7OJ
- VHF and UHF Receivers and UHF and Microwave Techniques sections  
from previous editions of the *ARRL Handbook*.
- Performance Capability of Active Mixers by Dr Ulrich Rohde, N1UL
- Note: Selected Hands-On SDR: columns in *QEX* since 2014  
by Scotty Cowling, WA2DFI are included in the Chapter 14 folder

### Projects

- A Dual Band Low Noise Amplifier for 2 Meters and 70 Centimeters  
by Jim Kocsis, WA9PYH
- A High Performance 45 MHz IF Amplifier for an Up-Conversion HF/LF Receiver  
by Colin Horrabin, G3SBI
- A Long-wave Upconverter by Fred Brown, W6HPH
- A Software-Based Remote Receiver Solution by Martin Ewing, AA6E
- A Software Controlled Radio Preselector by J. Onate, MØWWA and X. de Fortuny
- All Mode 1 kHz to 1.7 GHz SDR Receiver by James Forkin, WA3TFS
- Binaural Receiver project by Rick Campbell, KK7B
- General Coverage Preselector by George Hirshfield, W5OZF
- Receiver projects from previous editions of the *ARRL Handbook*.
- Rock Bending Receiver PCB template by Randy Henderson, WI5W
- Simple SDR Receiver by Michael Hightower, KF6SJ
- 10 GHz preamp PCB template by Zack Lau, W1VT

## Chapter 13

### Supplemental Articles and Columns

- Clean, Punchy, Competitive Contest Audio Without Splatter by Jim Brown, K9YC
- SDR: Simplified — Noise Reduction and Adaptive Filters by Ray Mack, W5IFS
- SDR: Simplified — Demystifying PID Control Loops by Ray Mack, W5IFS

### HF Transmitter and Transceiver Projects

- Transmitter and transceiver projects from previous editions of the *ARRL Handbook*.
- The Tuna Tin 2 Today by Ed Hare, W1RFI
- The MicroT2 — A Compact Single-Band SSB Transmitter by Rick Campbell, KK7B
- The MkII — An Updated Universal QRP Transmitter by Wes Hayward, W7ZOI
- Designing and Building Transistor Linear Power Amplifiers Parts 1 and 2  
by Rick Campbell, KK7B
- A Homebrew High Performance HF Transceiver — the HBR-2000  
by Markus Hansen, VE7CA
- The Rockmite — A Simple Single-Band CW Transceiver by Dave Benson, K1SWL
- The TAK-40 SSB/CW Transceiver by Jim Veatch, WA2EIJ
- A Fast TR Switch by Jack Kuecken, KE2QJ

### VHF/UHF Transmitter and Beacon Projects

- VHF Open Sources by Rick Campbell, KK7B – Article and parts placement
- A 50 MHz CW Beacon by Michael Sapp, WA3TTS
- VHF and UHF CW Beacons by Michael Sapp, WA3TTS
- A 2-Meter Transmitter for Fox Hunting by Mark Spencer, WA8SME
- Simple Frequency Doublers with High Performance by Paul Wade, W1GHZ
- A Microwave Transverter Controller by Hamish Kellock, OH2GAQ
- A West Coast Lightwave Project by S. McDonald, VE7SL, and M. Hansen, VE7CA

The following related items are included with the Chapter 12 supplements.

- Amateur Radio Equipment Development — An Historical Perspective  
by Joel Hallas, W1ZR
- Selected SDR: Simplified columns in *QEX* by Ray Mack, W5IFS

## Chapter 14

### Supplemental Articles

- SDR: Simplified — Demystifying PID Control Loops by Ray Mack, W5IFS
- SDR: Simplified — Step One Toward a Working SDR by Ray Mack, W5IFS
- Hands On SDR — Introduction by Scotty Cowling, WA2DFI
- Hands On SDR — FPGAs by Scotty Cowling, WA2DFI
- Hands On SDR — More on FPGAs by Scotty Cowling, WA2DFI
- Hands On SDR — Using FPGAs in SDR Designs by Scotty Cowling, WA2DFI
- Hands On SDR — Sharing Radios on the Network by Scotty Cowling, WA2DFI
- HF Receiver Testing by Adam Farson, AB7OJ/VE7OJ

### Projects

- Digital Signal Processing and GNU Radio Companion by John Petrich, W7FU
- Digital Signal Processing (DSP) Projects: Examples of GNU Radio and GRC Functionality by John Petrich, W7FU, and Tom McDermott, N5EG
- Hardware Building Blocks for High Performance SDRs by Scotty Cowling, WA2DFI
- A Panadapter for Your Transceiver or Receiver by Jim Kocsis, WA9PYH
- Build Your Own IF SDR by Alex Schwarz, VE7DXW and Guy Roels, ON6MU
- SDR Panadapters – A Practical Guide by Ed Krome, K9EK

Also see the **Transmitting** chapter online supplemental content for transmitter and transceiver projects from previous *ARRL Handbooks*.

## Chapter 15

### Supplemental Files

- Table of Digital Modulation Modes and Formats
- Digital Modes - Lowest Permitted Amateur Frequency
- ASCII and ITA2 code tables
- Varicode tables for PSK31, MFSK16 and DominoEX
- Operating Tips for Digital Voice Using *FreeDV* by Mel Whitten, KØPFX
- High-Speed Wireless Networking in the UHF and Microwave Bands  
by David Bern, W2LNX, and Keith Elkin, KB3TCB



## Chapter 16

### 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 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
- Designing to Avoid Interactive Tuning and Load Adjustments  
by John Stanley, K4ERO
- 135 Degree Pi Network Calculator Spreadsheet by John Stanley, K4ERO

### 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
- 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
- Simple Broadband Solid-State Power Amplifiers by Paul Wade, W1GHZ

### **UHF/Microwave Amplifier Projects**

- 432 MHz 3CX800A7 Amplifier by Steve Powlishen, K1FO
- A High-Power Cavity Amplifier for the New 900-MHz Band by Robert Sutherland, W6PO
- 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
- Getting Started with DMR and DSDPlus by Andrew Milluzzi, KK4LWR

## Chapter 19

### Supplemental Articles

- The Penticton Solar Flux Receiver by John White, VA7JW and Ken Tapping
- Hands-On Radio: Recording Signals by Ward Silver, NØAX
- The Reverse Beacon Network by Pete Smith, N4ZR and Ward Silver, N0AX)
- The Solar Eclipse QSO Party by Ward Silver, N0AX
- F-Region Propagation and the Equatorial Ionosphere Anomaly  
by Jim Kennedy, K6MIO/KH7
- The New Sunspot Numbers by Carl Luetzelschwab, K9LA
- Gray Line Propagation, or Florida to Cocos (Keeling) on 80m by Ed Callaway, N4II

### Projects

- Build a Homebrew Radio Telescope by Mark 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
- Simple Splice for 7/8 Helix by Ott Fiebel, W4WSR

- Splicing Window Line by Joel Hallas, W1ZR
- Octave for Complex Characteristic Impedance by Maynard Wright, W6PAP
- Radio Frequency (RF) Surge Suppressor Ratings for Transmissions into Reactive Loads by Gene Hinkle, K5PA

## Chapter 21

### Supplemental Articles

- Direction Finding Techniques by Joe Moell, KØOV
- A Simple Direction-Finding Receiver for 80 Meters by Dale Hunt, WB6BYU
- Weatherizing Outdoor Inductors and Traps by Dick Sander, K5QY

### HF Projects

- Rotatable Dipole Inverted-U Antenna by L.B. Cebik, W4RNL
- Construction details for Top-Loaded Low-Band Antenna by Dick Stroud, W9SR
- The Trimox — A Moxon Tribander for a Holiday DXpedition  
by Brian Machesney, K1LI
- Five-Band Two-Element Quad by Al Doig, W6NBH, and William Stein, KC6T
- K8SYL's 75 and 10-Meter Dipole by Sylvia Hutchinson, K8SYL
- Wire Quad for 40 Meters by Dean Straw, N6BV
- Vertical Loop Antenna for 28 MHz
- Having a Field Day with the Moxon Rectangle, by L.B. Cebik, W4RNL
- Extended Double-Zepp for 17 Meters
- Triband Dipole for 30, 17, and 12 Meters by Zack Lau W1VT
- A Compact Multiband Dipole by Zack Lau W1VT
- The W4SSY Spudgun by Byron Black, W4SSY
- An Off-Center End-Fed Dipole for Portable Operation on 40 to 6 Meters  
by Kai Siwiak, KE4PT

### VHF and UHF Projects

- 6-Meter Halo Antenna for DXing by Jerry Clement, VE6AB
- A New Spin on the Big Wheel by L.B. Cebik, W4RNL, and Bob Cerreto, WA1FXT
- Quick and Cheap Omni Antenna for 1296 MHz by Paul Wade, W1GHZ

- Dual-Band Antenna for 146/446 MHz by Wayde Bartholomew, K3MF
- A Simple Fixed Antenna for VHF/UHF Satellite Work, by L.B. Cebik, W4RNL
- A True 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
- Medium-Gain 2 Meter Yagi by L.B. Cebik, W4RNL

## **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
- F Compression Installation Instructions

## **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
- Repurposing Obsolete Instrument Enclosures by Scott Roleson, KC7CJ

## Chapter 24

### Supplemental Files

- Product Review: A Look at Gasoline Powered Inverter Generators,  
by Bob Allison, WB1GCM
- Field Day Towers - Doing it Right, by Don Daso, K4ZA and Ward Silver, NØAX

## Chapter 25

### Supplemental Files

- Cathode ray tube theory
- Test and Measurement Bibliography
- ARRL Lab Test Procedures Manual – 2010

### 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
- Noise Instrumentation and Measurement by Paul Wade W1GHZ
- 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
- No-Fibbin' RF Field Strength Meter by John Noakes, VE7NI
- E- and H-Field Probes by Ward Silver, NØAX

## 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
- Can Home Solar Power and Ham Radio Coexist? by Tony Brock-Fisher, K1KP
- Building Contest Scores by Killing Receive Noise — Parts 1 and 2  
by Jim Brown, K9YC

### Projects

- A Home-made Ultrasonic Power Line Arc Detector and Project Update  
by Jim Hanson, W1TRC
- 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

## 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
- Radio Frequency (RF) Surge Suppressor Ratings for Transmissions into Reactive Loads by Gene Hinkle, K5PA

### Image Communications

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

### Station Accessories and Projects

#### 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  
(plus source code and support files)
- Tandem Match—Accurate Directional Wattmeter by John Grebenkemper, KI6WX
- Two QSK Controllers for Amplifiers by Jim Colville, W7RY  
and Paul Christensen, W9AC (plus source code and support files)
- 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
- Arduino CW Serial IDer by Bob Anding, AA5OY (plus software/support files)
- PICAXE-Based Timer by Darrell Davis, KT4WX (plus software/support files)
- A Digital Interface in Time for Field Day by Julian Moss, G4ILO



## **Support Files**

- Support files for SWR Monitor by Larry Coyle, K1QW
- Trio of Computer Interfaces PCB template

## **Space Communications**

- Working Digipeaters with the Kenwood TH-D72A and TH-D74A  
by Joe Kornowski, KB6IGK and Patrick Stoddard, WD9EWK
- Devlish Doppler: Critical Knowledge for Successful EME on the Higher Bands  
by Al Katz, K2UYH
- SatNOGS: Satellite Networked Open Ground Station by Daniel White, ADØCQ

