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QST Reviews

KM3KM Electronics Mercury LUX Solid-State 160- to 6-Meter Linear Amplifier

RadioBuilder RadioLab V2

JNCRadio Chelegance MC-599 Portable HF Dipole Antenna

Arrow Antenna GP 146/440 Quarter-Wave Ground Plane Antenna

vates for excessive drain voltage, drain current, or drive power. Protection also activates if you transmit continuously with more than 800 W for more than a few seconds, if the reflected power exceeds 125 W, or if the temperature exceeds 65°C (149°F). The bar graphs on the front-panel display have labels that show the safe operating limits (for example, the red **45** below the **D.CURRENT** bar). The amplifier switches to standby, a red warning message appears on the display, and an audible alarm sounds (if enabled in the **DISPLAY SETTINGS** menu). Touching the red **RESET** button on the display restores operation once the fault is corrected.

I tripped the continuous carrier warning while transmitting steadily at 1500 W for more than 8 seconds while shooting photos for this review. The red warning message and alarm sound got my immediate attention. I also tripped the reflected power protection when a coaxial feed line in my station failed unexpectedly. In that case, the amplifier reacted instantly and took itself offline as soon as I sent one dit on CW.

The instructions don't offer a maximum SWR limit for antenna systems used with the Mercury LUX, but the 125 W reflected power limit equates to an SWR around 1.8:1 at 1500 W output. On 17 meters, my multiband beam presents an SWR of 2:1, and I was able to transmit at reduced power by keeping the indicated reflected power below 125 W. If you are using a multiband antenna that requires a tuner on some bands, consider the KM3KM Mercury ATS or another automatic high-power antenna tuner.

Wrapping Up

The amplifier easily met its power output specifications and showed no signs of stress or overheating even during some long operating periods on CW and digital modes. TR switching is relay-based, and there is a noticeable click each time the relay closes. Although the Mercury LUX doesn't support QSK operation, I found the TR turnaround time quick enough for fast CW contacts. Listening on another radio, I didn't hear any shortening of the first transmitted character.

I found the KM3KM Mercury LUX to be very easy to set up and enjoyable to use. The front-panel display is attractive and easy to understand. On-screen controls and indicators are clearly labeled and work as expected. Its light weight and small footprint make it easy to handle and fit into a station layout. If you use the PC remote-control software, you can place the amplifier off to the side somewhere, but you do need to be able to reach the power switch.

Manufacturer: KM3KM Electronics, LLC, Miami, FL, **www.km3km.com**. Price: $4,300.

RadioBuilder RadioLab V2

Reviewed by Glen Popiel, KW5GP
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One of the issues often confronting hams desiring to build high-tech radio projects is finding where to get hands-on experience learning the various components and sections involved in designing and constructing a more advanced radio using modern integrated circuit (IC) technology, as well as having a good platform to create these projects. While the basic building blocks of a radio transceiver haven't changed all that much over the years, the modular functions of today's high-powered ICs have changed the game in a major way.

When I heard about RadioBuilder's RadioLab, my first thought was that this would be an ideal opportunity to bring my own radio-building skills and project ideas into the 21st century. In this regard, RadioLab did not disappoint.

Bottom Line

The RadioBuilder RadioLab is a powerful and flexible platform to design, build, and test high-tech radio projects on a section-by-section basis.

Figure 6 — The RadioLab graphic display module.

Description

The RadioLab V2 full kit review unit came as what I would refer to as a semi-kit, with the surface-mount components pre-soldered to the circuit board, and I would have to install the remaining through-hole components. The kit consists of all of the building blocks needed to learn, design, build, experiment with, and test advanced modern radio projects.

The RadioLab system consists of a single 8 × 12½-inch-wide circuit board (see the lead photo), with the various hardware "building blocks" arranged in sections by circuit function in a clockwise path around the board. There are three prototyping areas in the center of the board. Starting at the top left corner of the board, there's the starting point of the receiver, the RF filter. Continuing clockwise is the double-balanced RF mixer, wideband RF amplifier, IF filter, variable gain IF amplifier, double-balanced IF mixer, power in, audio amplifier, and variable frequency oscillator (VFO). Next, you have the thin-film transistor (TFT) color display module (see Figure 6) and the ESP32 microcontroller used to control the radio functions. Finally, a spectrum analyzer detector has been included on the board for testing purposes.

In the center of the board, there are three prototyping areas. Two of the areas have a four-pin connector, called a *plug-in*, used to provide power and ground to a mounted circuit board. The third prototyping area has a breadboard, allowing you to build and test new designs quickly and easily. The review unit included the AM/FM/SW radio and the RF amplifier plug-in modules, which I installed in the two open prototyping areas. A series of jumpers and SMA coax cables are used to link the various sections together. This allows for the creation of your own external "building block" circuits to build and test your own designs on a section-by-section basis.

The Assembly

To complete the assembly of the RadioLab, I needed to attach some through-hole components, test point loops, standoffs, and other general hardware to the board. All of these components are supplied in individually labeled anti-static bags, which made the assembly very easy and straightforward. It took about 6 hours to assemble the RadioLab board. The hardest part was winding the various toroids used on the board. The full kit also includes a laser-cut wooden enclosure to provide a stable platform for the RadioLab board. For the most part, the only tools you'll need to assemble and test the board are a multimeter, a 12 – 13.8 V dc power supply, and a 4 – 8 Ω speaker. Recommended optional tools are an RF signal generator, a vector network analyzer, an oscilloscope, and a spectrum analyzer.

The assembly instructions for the RadioLab are probably the biggest weakness of the RadioLab. At several points, specifically involving toroid core selection and placement, I had to study the color photos in the instructions and watch the videos on the RadioBuilder website to determine which core to use. I highly recommend watching the build videos on the RadioLab website (see **https://radiobuilder.org/?docs=radiobuilder/radiolab-v2**), as they were a big help in clarifying the assembly process. Also, one step calls for the tuning of the RF filter section, which involves the use of an RF signal generator and an oscilloscope. Because most radio designers and builders would already have such test equipment available, this most likely would not be a big issue, but the instructions should probably be changed to reflect that this test equipment and assembly step are required and not optional. Having the toroids pre-wound would also help make this an easier step.

At the heart of the RadioLab is an Espressif ESP32 microcontroller used to drive the TFT display, the Skyworks Si5351 programmable clock generator IC, and the Skyworks Si4735 AM/FM/SW/LW radio receiver IC. These components allow the creation of modern and advanced transceiver designs with just a few jumpers. Using the various prototyping areas and the external connectivity features of the RadioLab, you can easily incorporate your designs for testing AM, FM, and SSB radio designs for HF, VHF, and UHF frequencies.

The RadioLab circuit board is well constructed and nicely laid out. Each section has the ability to be patched in or out of the radio circuit path, allowing for the easy insertion of external circuits to experiment with your own designs on a section-by-section basis.

The attention to detail in the functionality of the board is quite impressive. Provision has been made to add a variety of external components and functions to the board, such as an external audio mute for transceiver operation, external AGC voltage inputs, and more.

I did have some issues with installing the software to test the RadioLab. This was caused by updates to the third-party software libraries used in the RadioLab software. Working with Louis Ryan, EI8KI, the owner of RadioBuilder and the designer of the RadioLab, I resolved these issues quickly, and I was able to continue testing the board. There are several projects on the RadioLab website that can be used to learn how to use the various sections of the RadioLab and get started on creating your own designs, including the on-board spectrum analyzer. The basic RadioLab without any plug-in boards allows you to create a superheterodyne HF receiver that is also used to test all of the sections of the board when assembly is complete.

The RadioLab features an Si5351 with three separate 2.5 kHz – 200 MHz outputs for the VFO, the Si4735 AM/FM receiver IC, and the mixer sections that use the ADE-1 RF mixer from Mini-Circuits. The ADE-1 is a double-balanced mixer, with a frequency range of 0.5 – 500 MHz, with low isolation loss and port isolation of 55 dB. The RadioLab also uses a BGA2815 low-noise (3.8 dB) wideband amplifier chip with 25 dB gain for the 0 – 2 GHz RF amplifier section, and features a 60 dB gain IF amplifier section, and finally, a TDA7266M 7 W audio amplifier section. The crystal filter section implements a four-crystal ladder filter at the 9.21 MHz IF frequency.

Experimentation

What I really like about the RadioLab is that simply through the use of jumpers and SMA cables, you can experiment on just one section of the radio at a time, without having to build an entire radio every time you want to experiment with a new design, tremendously speeding up the design and testing process. One important thing to note is that the RadioLab is not an entry-level system to learn how radios work. Instead, it is a very powerful platform to design and build more complex radio projects in a modular fashion and implement the latest technology.

On-the-Air Tests

To test the performance of the RadioLab in a real-life scenario, I hooked it up to my end-fed wire antenna, configured the on-board jumpers, and uploaded the firmware for the superheterodyne receiver, using the recommended basic board layout. The receiver portion of the board performed quite well, and the variable IF gain proved very useful when dealing with strong signals. But it was the audio amplifier section that really stood out. Based on the 7 W TDA7266M mono bridge amplifier, the audio from the RadioLab was very pleasant and had no background noise. The added audio low-pass filter jumper was great at removing the high-frequency static hiss, and while listening to a pileup on 40-meter CW, the audio quality and the RF/IF filtering features allowed me to copy multiple stations in the pileup at once. All in all, the RadioBuilder proved to be a good platform to develop your own radio designs, section by section, testing, and refining each section along the way.

Conclusion

The RadioLab system also offers an SDR plug-in module. An analog FM broadcast module, a 2-meter ham module, and a class-A/B audio plug-in module are also in development.

Manufacturer: RadioBuilder, **www.radiobuilder.org**. Price: RadioLab V2 complete kit, $360; the complete kit with plug-in modules, $545. You can buy the plug-in modules independently for $167. All prices are without shipping (approximately $50 in the US).

JNCRadio Chelegance MC-599 Portable HF Dipole Antenna

Reviewed by John Leonardelli, VE3IPS
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The Chelegance MC-750 vertical antenna, previously reviewed in the August 2024 issue of *QST*, has been my go-to vertical antenna for portable operations. Its build quality exceeded my expectations, and after a full year of use, I remain impressed by its performance and durability. Typically, I deploy two antennas during my field outings, which led me to seek a suitable dipole-based solution to complement the vertical.

I also needed a standalone antenna for situations where verticals aren't feasible, whether due to hard ground preventing spike insertion, local park bylaws protecting