Mark J. Wilson, K1RO, k1ro@arrl.org

ACOM 600S 160 – 6 Meter Linear Amplifier

A rugged, lightweight 600 W solid-state amplifier with all the modern conveniences.

Reviewed by Mark Wilson, K1RO
QST *Product Review Editor*
k1ro@arrl.org

It's been more than 15 years since ACOM, the Bulgarian amplifier manufacturer, entered the US market with the ACOM 2000A, a legal-limit, auto tune, tube-type amplifier for 160 through 10 meters.[1] Well-built, reliable, and quiet, the 2000A was an instant hit, particularly among contesters and DXers. ACOM followed the 2000A with a succession of manually tuned, tube-type power amplifiers at power levels ranging from 700 to 1500 W.

ACOM's latest offering, the 600S, is another automatic design, this time using solid-state technology to deliver 600 W or more from 160 through 6 meters. Medium power amplifiers are popular. They offer a noticeable improvement in signal strength, yet can be operated from a 120 V household outlet if 240 V ac is not available, and they are priced somewhat lower than the deluxe, legal-limit models. Solid-state models such as the 600S are easy to operate, requiring no retuning with band changes and incorporating extensive protection circuitry.

Overview

The ACOM 600S is a compact amplifier. At 6.3 × 15.2 × 13.9 inches (HWD), it's not much bigger than some desktop transceivers. At less than 27 pounds, it's easy to move around a home station or take along for a DXpedition or Field Day.

The *ACOM 600S Operating Manual* includes a two-page partial schematic/block diagram and an extensive Theory of Operation section. The amplifier uses a pair of Freescale Semiconductor MRFE-6VP6300H RF power MOSFET modules configured as a parallel push-pull amplifier operating in class AB. The manufacturer specifies these devices for operation in very high VSWR applications. A 10 dB input attenuator and broadband input matching circuit present a low SWR to the transceiver on all bands. We were able to drive the amplifier to its rated output with around 25 to 35 W, depending on band (see Table 1) and saw more than 700 W output before triggering overdrive protection. On the output side, harmonics are attenuated by relay-selected low-pass filters for 160, 80, 40, 30, 20, 17/15, 12/10, and 6 meters. The 600S had no trouble exceeding FCC spectral purity requirements.

Bottom Line

The ACOM 600S solid-state linear amplifier effortlessly delivers 600 W from 160 through 6 meters. It integrates well with a variety of transceivers.

A built-in switching power supply provides 50 V dc at high current for the MOSFET devices, along with 5, 13, and 26 V dc for various switching and control modules. The power supply uses LC filters at the input and output and the 600S is specified to comply with European Commission (CE) electromagnetic compatibility (EMC) standards. The power supply can operate from 85 – 132 V ac with 10 A fuses, or 170 – 265 V ac with 6.3 A fuses. The ac line fuse holders are on the rear panel. Just install the correct power plug for your station, make sure the right fuses are installed, and plug it in — no jumpers or switches are needed to select the ac mains voltage.

The ACOM 600S has two ac power switches. The ON/OFF rocker switch on the rear panel controls ac to the power supply input, but is left ON continuously during normal operation. That places the amplifier in the "low energy (waiting) mode." Press the front panel ON/OFF button, and the amplifier goes through its start-up procedure. The display comes to life and the 600S enters the "working mode" for use on the air. Pressing the front panel button again returns the amplifier to the waiting mode. This arrangement allows the amplifier to be turned on and off remotely.

By default, when you turn on the amplifier it goes into the STANDBY mode. Press the OPR/STB button to switch it to OPERATE. The USER PREFERENCES menu includes an AUTO OPERATE option. When AUTO OPERATE is active, the amplifier goes into OPERATE mode when you turn it on. AUTO OPERATE also affects how the protection features work.

[1]D. Sumner, K1ZZ, "ACOM 2000A HF Linear Amplifier," Product Review, *QST*, May 2000, pp 64 – 66.

Controls and Menus

One of the most intriguing aspects of the 600S is its simple front panel. (Note that ACOM has changed the front panel design since we purchased the review unit, but the functions have not changed.) Other than the ON/OFF switch, all control, metering, and monitoring functions are handled by a 5-inch color TFT screen with six pushbuttons below (Figure 1). During operation, the "basic screen" shows parameters such as band of operation, forward and reflected power, and PA temperature. Indicators along the bottom of the screen show if the amplifier is in OPERATE or STANDBY or AUTO OPERATE mode, if the TR relay is activated, if the amplifier operating frequency is set to follow the transceiver (CAT/AUX CONTROL), and if the amplifier is under remote control.

Pressing the MENU button brings up a list of menus for monitoring or changing amplifier operation.

The AMP MEASURE menu displays measurements including input power, forward and reflected power, output power, SWR, power gain, PA bias for each PA transistor, PA voltage, and PA current. You can select two of these parameters to display on the basic screen in the bar under the band of operation.

The AMP SERVICE menu is used to check the idling drain current of the PA transistors and to test relay and fan operation.

Table 1
ACOM 600S, serial number 140131

Manufacturer's Specifications	Measured in ARRL Lab
Frequency range: All amateur frequencies in the range of 1.8 to 29.7 MHz, 50 to 54 MHz.	160, 80, 40, 30, 20, 17, 15, 12, 10, 6 meters.
Power output: 600 W, continuous.	HF, as specified; 50 MHz, 580 W.
Driving power required: Typically 25 W for 600 W RF output.	22 – 28 W typical, except 35 W on 17, 12, and 6 meters.
Input SWR: 1.2:1 or less from 1.8 to 54 MHz.	As specified.
Spurious and harmonic suppression: HF, >60 dB, typically 65 dB.	HF and 50 MHz, as specified, except 55 dB on 15 meters. Meets FCC requirements.
Third-order intermodulation distortion (IMD): <–28 dBc, –30 dBc, typical.	3rd/5th/7th/9th: 14 MHz: 42/39/49/55 dB below PEP; 50 MHz: 30/38/44/52 dB below PEP.
TR relay transition time: Not specified.	Unkey to key, 12 ms; key to unkey, 23 ms.
Primary requirements: 85 – 132, 170 – 265 V ac, 45 – 66 Hz.	Tested with 240 V ac.
Size (HWD): 6.3 × 15.2 × 13.9 inches (including protrusions).	Weight, 26.5 lb.
Price: $2800.	

The CAT/AUX SETTINGS menu (Figure 2) is used to set up the amplifier to interface with your transceiver via band data or RS-232. I e-mailed ACOM for information on settings for my transceiver, and a fast reply pointed me to the multipage on-screen HELP menu. There I found information needed to set up the amplifier to work with a variety of transceivers. (I hadn't realized that the HELP menu was more than one screen...)

The USER PREFERENCES menu is for functions such as AUTO OPERATE, beep volume and display brightness.

The FAULTS LOG menu displays information such as amplifier serial number, hardware and firmware versions, and total hours of operation. Along the bottom of the screen is information that can be used for troubleshooting in the event of an amplifier fault. The fault log can be sent as a text file through the RS-232 port.

Protection Features

The 600S incorporates a sophisticated automatic system to protect the amplifier from malfunction or operator error. The control

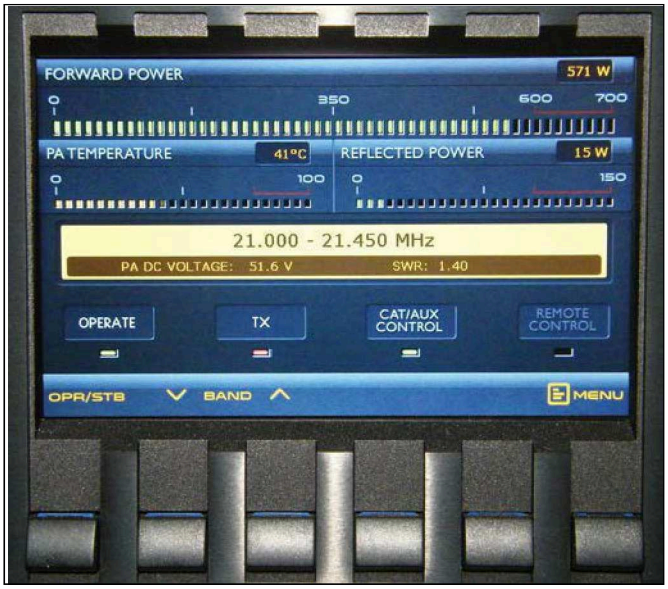

Figure 1 — The basic screen is visible during normal operation and shows many important operating parameters.

Figure 2 — The CAT/AUX screen is used to set up the transceiver interface so the amplifier will follow the transceiver's band changes automatically.

unit monitors parameters such as MOSFET drain voltage and current, bias voltage, heat sink temperature, drive frequency and power, forward and reflected output power, and TR relay switching times.

If anything is amiss, the amplifier responds in one of three ways. If a monitored value approaches a trip threshold, a warning message appears on the screen below the frequency display. The warnings are clear, for example, PA LOAD SWR TOO HIGH or DRIVE POWER TOO HIGH. If you correct the problem (for example, lower the drive level), then the warning goes away. If the problem persists and gets worse, then you get a "soft fault." When this happens, the 600S switches to STANDBY, and an error message detailing the problem is displayed on the screen. If AUTO OPERATE is active, the amplifier will stay in STANDBY for 4 seconds before returning to OPERATE. It will fault again if the problem is not corrected.

A serious problem triggers a "hard fault," which shuts off the main power supply, stores data about the fault in memory, blanks the front panel, and sounds a string of Morse code F characters. After a hard fault, the amplifier may or may not power up again depending on the problem. If it does, a fault message appears on the screen. The manual gives overheating as an example of a hard fault that is recoverable.

Documentation

The ACOM 600S includes a 44-page printed manual that covers installation, hookup, operation, and troubleshooting. Although the English is not perfect, I had no trouble understanding the manual or using it to install and operate the amplifier. The amplifier menus also include HELP screens that answer most questions.

Further documentation is available on ACOM's website, including a searchable PDF version of the manual, illustrated instructions for making cables to interface with a variety of transceivers, details of the PC serial protocol, firmware files, and software tools for loading firmware and troubleshooting faults.

Setup and Operation

Integrating the ACOM 600S into my station was simple. The rear panel (Figure 3) has SO-239 jacks for the transceiver and antenna, and a phono jack for TR switching (KEY IN), nine-pin S-sub connector for RS-232 and 15-pin D-sub connector for CAT/AUX band data. There's also a KEY OUT phono jack that you can use to control a transmit inhibit function on your transceiver if it is so equipped. You will need to supply any needed cables or connectors.

Figure 3 — The rear panel showing the cooling fan and available connections.

I have a 240 V line in my station, so I installed a matching plug and checked to see that the correct 6.3 A fuses were installed. ACOM supplies extra fuses.

There is no ALC connection for the transceiver, so you need to adjust your transceiver's power output accordingly. The amplifier's protection circuit trips immediately if the drive level is too high. My Kenwood TS-590S power output control is not continuously variable, but works in 5 W steps. I had no trouble setting the ACOM's power output to just under or just over 600 W with 25 – 35 W drive, depending on band.

To switch bands, you can either connect an appropriate cable between your transceiver and the CAT/AUX connector, rely on the built-in frequency counter, or use the BAND UP/DOWN buttons on the front panel. At first I relied on the frequency counter. Change bands on the transceiver, send a dit or two on CW or speak a syllable or two on phone, and the amplifier will change to the correct band. There is a slight switching delay, so you need to pause before resuming transmission.

On RTTY, that didn't work as well because once started, the transmission is continuous (no convenient way to send a character or two and pause). When continuous, full-power transmission continues before the amplifier completes the band change, the result is often a soft fault for a band error. Phil Salas, AD5X, sent me a cable to connect the RS-232 jack on my TS-590S to the CAT/AUX jack on the 600S — problem solved. The amplifier follows the transceiver instantly at band changes.

Remote monitoring and control are possible using a computer connected to the RS-232 jack. You can turn the amplifier on and off, switch between operate and standby, switch between transmit and receive, change bands, and adjust some of the options. ACOM does not provide software (other than a terminal program to use for updating firmware), but a lot of information about the RS-232 interface is available for download from ACOM's website. I did not try this feature.

According to the manual, the 600S will work into an SWR of 1.5:1 at full power and up to 3:1 at reduced power. I found that the power did fold back a little, to about 550 W with a 2:1 SWR at the high end of 40 meters for example. I was glad that the amplifier worked with reduced power rather than tripping off when my antennas presented SWR higher than 2:1 in some portions of the band.

The ACOM 600S is rated for 600 W continuous, so I used it extensively during the ARRL RTTY Roundup in January. RTTY contesting typically mixes short full-power transmissions with short listening periods, repeated over and over again for long periods (in this case, 24 hours during the weekend). I kept a close eye on the PA temperature indicator, and it always stayed well within the safe range. The amplifier performed perfectly throughout the weekend.

Cooling air is drawn in through a large muffin fan on the back panel and escapes through vents in the top panel. There are four fan speeds, which increase as PA temperature increases. During ARRL Lab testing, Senior Test Engineer Bob Allison, WB1GCM, noted that Fan 1 normally is on and is quiet. Fan 2 turns on at 50 °C, and drops back to Fan 1 at 47 °C. Fan 3 turns on at 60 °C, and Fan 4 turns on at 63 °C. After 11 minutes of key down at full rated RF output, the PA temperature was 66 °C.

During normal CW or SSB operation, the fan runs at low speed and is quiet. It did run faster during the RTTY Roundup when PA temperature exceeded 50 °C. With headphones on, even the higher speed was not bothersome.

Click here to see a video overview of the ACOM 600S 160 – 6 meter linear amplifier.

Final Thoughts

The ACOM 600S is rugged and well built, yet compact and lightweight. It performed flawlessly during the review period, delivering the promised 600 W or more on all bands. It stayed cool even during extended contest operation. Although the amplifier is made in Bulgaria, sales and service are readily available from US dealers. Factory support was excellent as well; I received fast and useful help when I contacted them via e-mail with questions.

Manufacturer: ACOM OOD, Blvd Nikola Mushanov 151, 1330 Sofia, Bulgaria; **www.acom-bg.com**. Available from several US dealers.

MFJ 1742 Extended Double Zepp Wire Antenna

Reviewed by Steve Ford, WB8IMY
QST *Editor*
wb8imy@arrl.org

When it comes to straightforward, multiband HF antennas, it is hard to beat the tried-and-true strategy of simply cutting two equal lengths of wire, as long as possible, and feeding them at the center with 450 Ω windowed "ladder line." With a wide-impedance-range antenna tuner, chances are you'll load that antenna on many bands. Thanks to the low-loss characteristics of the feed line, you'll deliver plenty of RF to the antenna, even at high SWRs. Although the label is technically a misnomer, many amateurs refer to this type of dipole antenna as a "Double Zepp."

As you tweak the lengths of these antennas, you find that interesting things begin to happen when the total length exceeds a half wavelength for the frequency in question. When the antenna becomes one wavelength long at a given frequency, for example, it may offer about 1.5 dB gain relative to a standard half-wavelength dipole. If you increase the length of the antenna yet again to about 1¼ wavelength, you'll realize significantly more gain, depending on the frequency, of course. These antennas are often called "Extended Double Zepps." Ward Silver, N0AX, wrote about these antennas in his "Hands-On Radio" column last year.[2]

The MFJ-1742

At about 85 feet in length, the MFJ-1742 antenna is designed to behave as an Extended Double Zepp on 20 meters. Since we lack an HF antenna test range at ARRL Headquarters, I wasn't able to measure the antenna's gain and directivity. However, Joel Hallas, W1ZR (aka *QST*'s "The Doctor"), generated *EZNEC* models of the MFJ-1742's performance. Assuming one can hang the antenna horizontally at least 35 feet above ground, the model suggested significant directivity on 20 meters, which is the result you'd expect on that band. MFJ also indicates that with the proper wide-range antenna tuner, the MFJ-1742 will give good results over the range of 5 to 50 MHz and may work acceptably well on 80 meters. Joel also modeled the antenna on 40, 15, and 10 meters, and the models suggested decent performance on those bands.

The MFJ-1742 arrives completely assembled with multistranded copper wire, ceramic insulators, and 100 feet of 450 Ω windowed ladder line already attached to the center (Figures 4 and 5). I live on a small lot with few supports, so I wasn't able to hang the antenna horizontally. Instead, I decided to install it as a rather "open" inverted V with the apex of the antenna dangling in a pine tree at 35 feet. Each leg descended to a wooden privacy fence at a height of 7 feet.

At the base of the tree I had a remote automatic antenna tuner with a 4:1 balun. So, I only needed about 40 feet of ladder line to

[2]W. Silver, N0AX, "Experiment #133 — Extended Double Zepp Antenna," Hands-On Radio, *QST*, Feb 2014, pp 66 – 67.

Bottom Line

The MFJ-1742 Extended Double Zepp antenna offers some gain and directivity on 20 meters, and will also work on 40 through 10 meters with an appropriate wide-range antenna tuner.

Figure 4 — The MFJ-1742 arrives preassembled with 100 feet of 450 Ω ladder line.

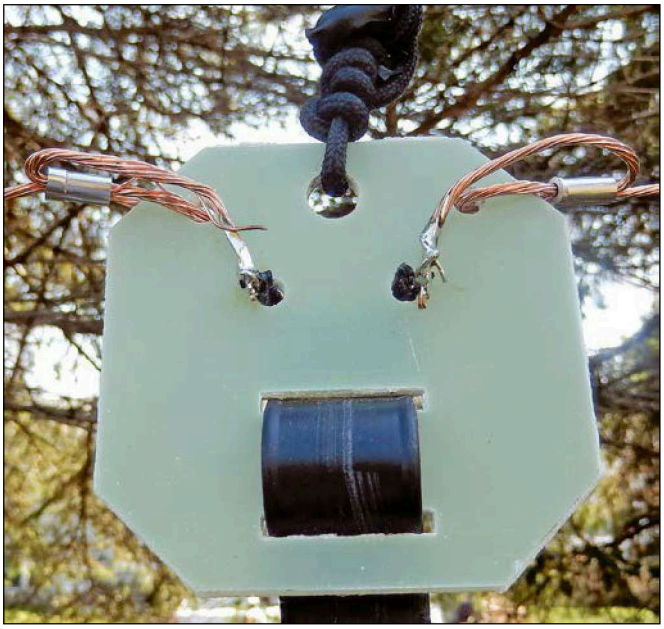

Figure 5 — The center of the MFJ-1742.

reach the tuner/balun; the rest went into my ladder line collection for future use. From the tuner, a 50-foot length of LMR400 coaxial cable made its way into my station.

I assumed that my remote tuner would achieve an acceptable match on several bands with the MFJ-1742, but I was astonished to find that it provided less than a 1.5:1 SWR on *every* band from 80 through 6 meters. Oddly enough, the tuner also achieved a 1.2:1 match on 160 meters, but I was hesitant to push my luck on that band.

It is important to note that the length of the ladder line will have a substantial impact on the total impedance present at the tuner. For my installation, 40 feet of ladder line may have been a "magic" length. Had I been using another length, my results may have been different. As the automobile commercials often state, your mileage may vary.

How It Played

The antenna performed remarkably well. Despite the less-than-optimum arrangement, the MFJ-1742 seemed to out-play my old multiband horizontal loop. Even in an inverted V installation, I could detect definite directivity on 20 meters. On higher bands the MFJ-1742's pattern becomes multi-lobed, but still it seemed to outperform my loop. At its low height, I suspect my MFJ-1742 is essentially a cloud warmer on 80 meters, but coverage throughout most of the eastern US was solid.

Manufacturer: MFJ Enterprises, PO Box 494, Mississippi State, MS 39762; tel 800-647-1800; **www.mfjenterprises.com**. Price: $79.95.

MFJ-618 Dual Channel Speech Intelligibility Enhancer

Reviewed by Joel R. Hallas, W1ZR
QST *Contributing Editor*
w1zr@arrl.org

The MFJ-618 Dual Channel Speech Intelligibility Enhancer accepts the audio output from either of two receivers and processes the single signal through two independent channels of filtering and amplification. The output can be supplied to stereo headphones or speakers to provide selectable emphasis centered in four frequency bands in each channel. Thus an operator can tailor receiver audio frequency response and