

Product Review

PreciseRF HG3 QRO-B Stepper Magnetic Loop Antenna

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I've had the opportunity to review the PreciseRF HG-1 (in the June 2019 issue of *QST*) and the HG3 PRO stepper-controlled magnetic loop antenna (in the January 2021 issue of *QST*). Now that PreciseRF has released the HG3 QRO-B, I was pleased to be able to review this antenna.

Description

The HG3 QRO-B is the high-power version of the PreciseRF HG3 Stepper Magnetic Loop Antenna series. The new HG3 plus controller is now the controller used with the HG3 EXPRESS, PRO, and QRO-B antennas. The main physical difference is that it has both an RJ45 control interface for the EXPRESS and PRO models, and a DB9 control interface for the QRO-B. The HG3 QRO-B covers 6 – 30 MHz and is rated up to 1000 W PEP depending on the band and mode. It consists of a 32.5-inch-diameter LMR-600 radiator loop; a copper tube induction loop; a high-resolution, remotely tuned, 45,000-position stepper motor-positioned large vacuum variable capacitor with a 5:1 planetary gear; the HG3 plus controller; an aluminum support mast; a dc power cable; and a 50-foot DB9-terminated weatherproof controller cable. There is also a 4-foot BNC/BNC cable that connects the remote tuner to the induction loop. Also available is an optional 80 – 30-meter add-on kit, which consists of a second loop that attaches in series with the supplied loop. When this option is installed, the antenna will not operate on 20 – 10 meters. Finally, a comprehensive illustrated user guide is included. Figure 1 shows the large vacuum variable capacitor inside of the tuning unit, and Tables 1 and 2 detail the HG3 QRO-B specifications.

Assembling the HG3 QRO-B

The HG3 QRO-B comes in two boxes. A 37 × 3.25-inch-diameter box contains the aluminum mast, and a 31 × 18 × 6-inch box contains the rest of the parts (see Figures 2 and 3).



PreciseRF recommends the use of a RadioWavz B1:1 ISO choke balun when high power is used. Because the coupling induction loop is balanced and the coax feed is unbalanced, common-mode currents will occur without the balun. This can cause issues with the control signals, as well as distort the radiation

Bottom Line

The HG3 QRO-B is designed for both portable and fixed station operation at up to 1000 W PEP. The remote-tuned stepper-controlled tuning results in precise, repeatable operation.

Table 1 PreciseRF HG3 QRO-B Magnetic Loop Antenna	
Manufacturer's Specifications (not tested by the ARRL Lab)	
SWR/return loss (RL)	Typically less than 1.2:1/21 dB RL at resonance
Impedance	50 Ω
Transmit power	See Table 2
Resolution bandwidth	600 Hz
Continuous tuning range	6 – 30 MHz
Tuning	Manual and auto
Tuning method	45K-step stepper motor (NEMA 17 Unipolar)
Radiation loop	LMR600, 113 square inches
Tuning capacitor	High-voltage vacuum variable
Quality factor (Q)	1765
Loop radiation resistance	0.054 Ω/14 MHz, 1.15 Ω/30 MHz
Vacuum capacitor equivalent	12.5 mΩ series resistance (ESR)
Power loss	1.46 dB/14 MHz, 0.14 dB/30 MHz
Efficiency	84.5%/14 MHz, 98.4%/30 MHz
Power requirement	12 – 14 V dc @ 2 A max; typically 1.5 A tuning, 0.2 A idle
Environmental	0 – 35 °C, < 70% RH, water-resistant but not waterproof



Figure 1 — The HG3 QRO-B high-power tuning unit.

Table 2 Maximum Power Directly Into the HG3 QRO-B			
Manufacturer's Specifications (not tested by the ARRL Lab)			
Frequency (MHz)	Digital/TTY	CW	SSB
7	400 W	600 W	800 W
14	600 W	600 W	800 W
28	600 W	800 W	1 kW

pattern. PreciseRF has an excellent video that shows the assembly and initial setup of the antenna (www.youtube.com/watch?v=QzqPZtdXzHA). Assembly is quite easy and will take you less than 30 minutes. The only thing missing in the video is how to mount the recommended choke balun. The Radio-Wavz choke balun has UHF connectors. So rather than using the supplied 4-foot RG58 BNC/BNC tuner-to-loop cable with UHF adapters, I purchased an RG58 12-inch BNC/PL259 cable and an RG58 20-inch BNC/PL259 cable from Amazon. The 12-inch cable connects from the balun to the induction loop, and the 20-inch cable connects from the balun to the tuning unit. I tie-wrapped the balun to the aluminum mast just above the tuning unit, as you can see in the lead photo.



Figure 2 — The reviewer, Phil Salas, AD5X, with the boxed-up PreciseRF HG3 QRO-B.



Figure 3 — The PreciseRF HG3 QRO-B opened boxes.

Installing the HG3 QRO-B

The HG3 QRO-B is easily handled by one person. It may be installed in a temporary or permanent location. Its aluminum mast can be attached to a secure support using U-bolts (not included), or to a tripod using its

½-inch pipe thread. The antenna is easily rotated with most rotators, including an inexpensive TV-type rotator or the PreciseRF VH226E programmable rotator, which is appropriate for either portable or fixed station use. The HG3 plus controller and the remote high-power tuner RF input use standard UHF SO-239 connectors.



For this review, I mounted the HG3 QRO-B to a mast attached to the side of my house at about the 15-foot level, as you can see in Figure 4. It is rotated with my Yaesu G-450ADC medium-duty rotator. Because the HG3 QRO-B is bidirectional, only a 90-degree rotation capability is needed. I shimmed up the QRO-B aluminum mast with some scrap PVC, as the QRO-B mast diameter was too small for my rotator.

Figure 4 — The HG3 QRO-B mounted on a pole at the reviewer's house.

Operating the HG3 QRO-B

Keep in mind that there is a very high RF field around the QRO-B, especially when running high power. PreciseRF recommends that the operator stay at least 25 feet from the antenna when transmitting.

The HG3 plus controller is powered by 12 – 14 V dc applied through the included 2.1 × 5.5-millimeter power cable. When the controller is powered on, it will ask if you want to initialize the tuner. This sets the minimum and maximum range of the vacuum variable, as well as sets the approximate capacitance for each of the ham bands. The initialization procedure takes only a minute or so. While you don't need to do this every time, you definitely want to do it your first time and any time you make changes to the antenna location. After initialization, the controller defaults to the basic operating screen and sets the band to 20 meters.

There are four soft keys labeled F1 through F4. The display indicates the function of these keys, and changes when keys are pressed to indicate the necessary next functions. The **MODE (F3)** key changes the display to show 80 – 30-meter information if the 80 – 30-meter kit is installed. The **HELP (F4)** key provides tuning information. The initialization and default screens are shown in Figures 5 and 6.



Figure 5 — The PreciseRF magnetic loop controller initialization screen.



Figure 6 — The PreciseRF magnetic loop controller default screen after initialization.

Once the default 20-meter screen is displayed, you can press the **BAND F1** key to permit decrementing (F1) or incrementing (F2) the bands. When tuning stops in the desired band, press **OK (F4)**. Now you will normally tune for maximum noise using the **TUNE** control. Tapping the **TUNE** control enables fine-tuning. You can then transmit a low-level signal and tune for best standing wave ratio (SWR). This is quick and easy to do by observing the SWR bar graph. It is interesting to note that when you change direction during tuning, the controller takes up any backlash by tuning in the opposite direction, followed by tuning in the desired direction. This causes a momentary increase in SWR. This is normal and doesn't affect tuning, though you should hesitate momentarily when manually changing tuning direction. Also, if you record the step count for your favorite frequencies, you can re-tune the QRO-B in short order when changing frequencies and bands.

There is a very effective auto-assisted tuning feature. To enable auto-tune, tune the controller for maximum noise on your transceiver. Then press **AUTO (F2)**. The controller will display "Transmit 2-10 watt CW." If you transmit over 10 W, the auto-tune feature may not always work. Transmit a low-power carrier and press **OK (F2)**. The HG3 QRO-B is automatically tuned until the lowest SWR point is found. This entire process takes just a few seconds and worked very well for me. I found that I didn't even need to tune for maximum noise first. Whenever I changed bands or frequencies within a band, I just went to **AUTO** and started the auto-tune process. In most cases, it tuned perfectly on the first try. If not, I would just repeat the **AUTO** process, and it would always find the correct solution the second time. I wound up using the **AUTO** feature whenever I changed bands and/or frequencies.

On-the-Air Operation

I made several measurements of the antenna resonance and bandwidth prior to my on-the-air tests. The results are shown in Table 3.

I operated with a transmit power up to 500 W using my K3/KPA500 setup (100 W maximum on 30 meters, of course). I operated CW (my preferred mode) on 30 meters, but focused on SSB on the other bands. I could pretty much work anyone I could hear. I also made many A/B comparisons between the HG3 QRO-B and my 43-foot vertical. On average, I found the HG3 QRO-B to be about 2 – 3 S-units

Table 3
Antenna Parameters Measured When the HG3 QRO-B Is Fed Through About 35 Feet of LMR-400 Cable

The SWR was recorded from the HG3 plus controller display.		
Band	SWR Minimum	2:1 SWR Bandwidth
40 m	1.3:1	16 kHz
30 m	1.3:1	20 kHz
20 m	1.2:1	50 kHz
17 m	1.1:1	70 kHz
15 m	1:1	85 kHz
12 m	1:1	Greater than full band
10 m	1.1:1	215 kHz

below the 43-foot vertical on 40 meters, and 1 – 2 S-units below the 43-footer on 30 meters. On 20 – 10 meters, the QRO-B was often equivalent to the 43-foot vertical and sometimes would outperform it. Of course, there were situations where one antenna significantly outperformed the other, but on average I observed the results stated. The HG3 QRO-B also had a better signal-to-noise ratio on all bands when compared to the 43-foot vertical.

Firmware Update

While the HG3 QRO-B manual states that firmware can be upgraded by the user, no information on doing this is provided. There is a warning that damage to the unit due to a user upgrade is not covered by the warranty. So, if you need to update the firmware, you should contact PreciseRF.

Conclusion

The PreciseRF HG3 QRO-B is an effective antenna worth considering for restricted antenna locations and portable operation at power levels up to about 1000 W PEP. Because it is remotely tuned, the high-intensity RF field can always be kept well away from the operator. You can review the HG3 QRO-B operation manual, the installation guide, and the installation video on the PreciseRF website.

Manufacturer: PreciseRF, 13690 Wisteria Dr. NE, Aurora, OR 97002, www.preciserf.com. Price: HG3 QRO-B, \$3,025; VH226F programmable outdoor antenna rotator, \$275; HG3 QRO 80 – 30-meter add-on kit, \$355.