QRP: Low-Power Communications

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CQ Reviews: *Laboratory 599's Discovery TX-500 – Worth the Wait?*

In late 2019, I learned about the upcoming release of the Laboratory 599 Discovery TX-500 (*Photo A*), a highly portable, ultra-compact, QRP transceiver designed to withstand the rigors of field operation. As more information about the transceiver became available in early 2020, I decided I had to see the TX-500 up close and determine, firsthand, if it met the manufacturer's claim that it is, "a radio tailored for adventure, for extremes, for use in places unattainable before, with no sacrifice of performance or features." Unfortunately, my plans to acquire the TX-500 in 2020 quickly faded due to the global pandemic. Laboratory 599, like many other businesses, had been temporarily shuttered waiting for the pandemic to pass. Unbeknownst to me, my XYL had pre-ordered the TX-500 as a surprise, but its shipment was postponed from fall 2020 to spring 2021. The TX-500 finally arrived in April and since then, I have completed numerous field excursions with this transceiver and feel confident I can attest to its ruggedness, features, and a commonly asked question amongst the QRP community: Is the TX-500 worth the wait?

Laboratory 599 – A New Face

Until recently I had not heard of Laboratory 599. To learn more about this new company I contacted their product support team via their website <http://lab599.com> and received the following information.

Lab 599 is a young company located in the Siberian region of Russia. The organizer and ideological inspirer of the team is Alexander Shishkin, UA9YPS, — a radio amateur (with) extensive experience in radio expeditions and designing radio equipment. The "backbone" of our team is Andrey Grebnev, R9YAJ, — an electronic engineer with vast experience, specializing in receiving and transmitting equipment; Sergey Makarenko, RA9YTJ, — a programmer, one of the best specialists in digital signal processing in Russia; and Roman Klyukin, a graphic designer and 3-D modeling specialist.

The company currently employs 18 people. All products are manufactured at our own production facilities — from idea and prototype development to finished products.

Our team members are enthusiastic travelers who are in love with the nature of their land. Many of them have extensive experience in both complex multi-day hikes and international expeditions, and it is this experience that we invest in the development of our products. Our goal is to create reliable, convenient and, above all, unique devices that would bring excitement and pleasure to radio amateurs like ourselves.

Because Laboratory 599 is new, some hams may be concerned about the level of service and support provided. Aside

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Photo A. The TX-500 atop a fallen tree on a remote beach – no worries!

Photo B. Custom flip-style box with compartments for the TX-500 and accessories.

Photo C. Clockwise from top left: CAT cable for software updates, speaker / microphone, CW adapter (3.5-millimeter jack), headset, and mic adapter with PTT (3.5-millimeter jacks), Velcro® strap (for wrapping cords), GX-12 7-pin connector, and power cable for an external power source (9-15 volts).

from the quick reply I received regarding my question about their company, I have had one other interaction with their product support team. Soon after receiving the TX-500 I requested a wiring diagram for the CW and mic / speakerphone sockets for constructing an external switchbox. The support team promptly emailed the information I requested and in addition, included wiring diagrams for all the radio's sockets (power, CAT cable, etc.) — a nice touch. Per their website, if something should happen to the TX-500 during its one-year limited warranty period or beyond, there is a service repair center in Reno, Nevada.

Ooh La La — The Unboxing

The TX-500 is packaged in a well-designed cardboard box with compartments for the radio, speaker, mic, and cables (*Photos B* and *C*). When I removed the transceiver from its box, I was deceived by its weight because it is so stout. The TX-500 weighs in at 1.2 pounds but looks like it should weigh a lot more. The transceiver's body is milled from an aluminum block and reportedly contains inner walls (aluminum) to help absorb shock and protect components in the event the radio is dropped. The aluminum casing also serves as a heat sink for the transmitter's finals. The exterior of the radio has a durable, abrasion-resistant, black anodized finish.

The design of the case is unique. The front of the case has built-in siderails that rise above the knobs on the face of the radio. If the transceiver were flipped face down, only the rails, not its knobs or high contrast LCD would meet the surface. The backside of the TX-500 is engraved with the company logo and contains two metal kickstands (one on each side of the radio) that flip down to support the radio when operating (*Photo D*). The case also has "bump outs" on each corner that provide an additional layer of protection.

Without question, the radio was constructed for protection against Mother Nature. Unlike some QRP radios I have used that have loose-fitting cases with gaps allowing insects, dust, and other debris to enter the radio, the TX-500 is rock solid with no openings. It is also equipped with five GX-12 aviation sockets for power (DC voltage), data and CAT cable connections, and connecting a speaker / mic and CW key to the transceiver. The antenna is connected via a standard BNC connector. To avoid any holes in the radio, there is no internal speaker. Instead, a speaker / mic

Photo D. Backside of the TX-500 with its metal kickstands deployed. The two tabs on the right side are connections for the detachable battery pack (available soon).

(that also includes a 3.5-millimeter socket for attaching an external speaker) is used. The knobs and buttons on the front of the radio have a rubber jacket and are sealed to prevent moisture and dust from entering. I have heard some hams refer to this radio as waterproof; however, I believe the proper term here is weatherproof. I do not believe the transceiver would fare well if it were dropped into a stream or a puddle during a field excursion; however, I would not be concerned if a light rain fell on the TX-500 or if I set up my field operation on a beach with blowing sand.

If you are a klutz like me and have spilled drinks next to your radio, dropped your radio on the ground, or have accidentally pushed your transceiver off the edge of a picnic table in haste to setup a portable operation, you will greatly appreciate the design and workmanship of the TX-500.

Basic Features and Layout

The TX-500 is a 32-bit software-defined radio (SDR) with an adjustable power output of 1-10 watts on 160 through 6 meters. It covers all modes (CW, SSB, AM, FM, and digital) and has a general coverage receiver (0.5-56 MHz). The transceiver is 3.5-inches high, 8.1-inches wide, and 0.8-inches deep. When cables (i.e., power supply, key, etc.) are plugged into the side mounted GX-12 connectors, its overall width increases to approximately 11 inches.

All of the TX-500's controls are located on its front panel. The VFO knob is the largest knob on the radio and doubles as a control for changing specific menu parameters. Two smaller knobs (AF gain and RIT/XIT control) are located above the VFO control. Six buttons (on/off for RIT/XIT, clear RIT/XIT, frequency memory, VFO lock, and VFO frequency steps) are located to the right of the VFO knob. To the left of the VFO knob are rubber function keys for power (on/off), band of operation, mode switching, passband filter settings, and a menu access button for additional functions.

The monochrome LCD (measuring approximately 3 inches wide by 1.75 inches high) comprises most of the left side of the radio and displays frequency and a bar graph showing an S-meter when in receive mode and a user selectable bar graph showing power output, SWR, mic gain, or ALC when in transmit mode. An information block showing the status of other functions (i.e., speech processor, noise reduction, notch filter, etc.) is located on the right side of the display. A spectrum analyzer (48-kHz wide) showing nearby frequencies in use (in real time) is located along the bottom of the display. Other notable information displayed includes supply voltage, a clock, and a high temperature alert in case the internal temperature exceeds 60° Celsius (140° Fahrenheit). If the TX-500 becomes too hot during operation (overheating the transmitter's output stage), the transmitter is automatically deactivated until a safe working temperature is reached.

There are a total of eight user-selectable menu function keys next to the LCD. Each key's function is displayed on the LCD after the menu button is pressed. The VFO knob is used in concert with the menu function keys to further adjust settings for a variety of transmit / receive features including VOX, CW pitch, RF gain, etc. One function I especially like is the "Tone" feature, which activates the transmitter and sends a tone which is helpful for checking / adjusting SWR (on a clear frequency, of course). When enabled, the transmitter's output (if set above 5 watts output) is automatically reduced to 50% (5 watts).

Depending on the amount of interference from nearby stations and band conditions (noise), one of the receiver's four user-selectable digital filters can be employed to attenuate and/or help remove unwanted interference. The filters are also adjustable to meet the operator's personal preference. The TX-500 also has two adjustable filters for the transmitter.

CW and SSB voice memories are another feature that has become a mainstay in many of today's transceivers. For CW, there are four memory slots, each with a duration of 25 seconds; and two memory slots for SSB, each with a duration of 20 seconds. The recording and playback memories are easy to set up and are a welcome feature for operating contests, POTA activations, and other events.

On the Air

After unboxing the TX-500 and glancing at the instructions, I wired Anderson Powerpole® connectors to the end of the supplied power cable, fired up the transceiver and made several phone and CW contacts from my QTH. I received no negative feedback on CW. Everyone I worked on phone reported my audio as excellent. In fact, several operators have told me on more than one occasion not to adjust any of the transmit audio / equalization settings as the audio sounds great right out of the box!

After making a few contacts, I turned on my ICOM IC-7300 to compare receivers with the same antenna. This was a high-level comparison using only my ears and S-meters for the comparison. Using the IC-7300 as my base reference, I found that the TX-500 could "hear" everything the IC-7300 could. Although there was a slight difference in S-meter readings between the two rigs (IC-7300 often reading a bit higher), I found no significant difference between the two receivers at face value. I should note that although I use my IC-7300 (with the power turned down to QRP levels) as my primary transceiver in the shack, I have been using the TX-500 at home more and more.

Like a lot of other radios today, the menu features and controls are self-explanatory and after few minutes of touch and play, one can master these functions. However, I do recommend spending a little time with the manual to learn the radio's more advanced functions and capabilities as it does have a lot of features.

One area I have not yet explored with the TX-500 is how it performs using digital modes. The TX-500 comes equipped with an audio cable that plugs into one of the GX-12 connectors; the only remaining items needed are a sound card, computer, and software of your choice. Getting on the digital modes with the TX-500 is on my to-do list and I will provide an update in the next column.

One of my initial concerns with the TX-500 was how well its monochrome LCD would show up on sunny days. Regardless of conditions (sunny, cloudy, etc.), I found the characters in the display to be sharp, clear, and easy to read. I have found that sunny conditions are not a detriment and that no adjustments or repositioning of the radio are necessary to read the LCD, whether outdoors or indoors.

Likes and Dislikes

I have a lot of likes and very few dislikes about the TX-500. Below are my findings after working with this radio for a couple of months.

Low Current Draw – The radio has very low current consumption making this an excellent field radio. The TX-500 boasts a current draw of 110 mA on receive and 1 to 2.5 amps of draw on transmit (dependent on output power). At these levels, I can operate for a long time with a small lithium-ion battery.

GX-12 Connectors – Before receiving the TX-500, I was concerned about the GX-12 connectors. They were foreign to me and I was not sure how well they would work. However, after I learned these connectors help make the radio weatherproof and discovered I cannot mistakenly plug the two-pin DC power cord into the five-pin CW Key socket, and vice-versa (remember, I am a klutz), I wonder why others in the industry are not using them. These connectors are a win and are readily available online, so don't fret if you want to customize your own plugs for a specific key, external speaker, etc.

No Built-In Battery Pack or Antenna Tuner – The TX-500 does not have a built-in power supply (battery pack) or an internal antenna tuner. Since I have historically used an external battery when in the field and deploy either resonant antennas (no tuner needed) or take along an external tuner for use with dipoles fed with twin lead, the absence of an internal power supply and antenna tuner does not trouble me. I am excited to say that Laboratory 599 is working on the release of an external battery pack (*Photo E*) that will attach directly to the back of the TX-500. The battery pack reportedly contains a compartment for six user-supplied 18650 lithium-ion batteries and is equipped with an on/off switch, a built-in charger, and LED indicators showing battery status. Using 18650 batteries is an ingenious idea (in my opinion) since these cells can be easily swapped out for new ones, when necessary. Note to my XYL — Honey, I will be purchasing this battery pack as soon as it becomes available.

Photo E. Laboratory 599's detachable external battery pack … coming soon. (Courtesy of Laboratory 599)

Lacks Full Break-In Keying – The TX-500 does not have full break-in (QSK) operation, but rather semi break-in operation as it uses a relay to switch between transmit and receive. CW operators who prefer full QSK operation and like to hear between dits and dahs may find this irritating.

User-Friendly Website – I find that Laboratory 599's website is easy to navigate and not littered with a lot of extraneous information. Tabs are located across the top of the webpage for additional information about the TX-500, available downloads (firmware updates), product support, and information on where to purchase. A form for contacting their technical support team is located under the product support tab. I used this form when I contacted Laboratory 599 regarding the GX-12 connector wiring diagrams, and as previously noted, I was impressed with their quick reply.

So, Is the TX-500 Worth the Wait?

After many years of using other QRP radios in the field, I find the TX-500 to be a great blessing. Its innovative design that incorporates siderails and bump-outs (for protection), weatherproofing, and rugged construction has set a new benchmark in the amateur radio industry for a field radio. Granted, there are other radios available for purchase that are marketed as field radios and do everything the TX-500 does and a lot more (including VHF and UHF coverage). However, after operating some of these radios, I have a concern that if they were jostled around in my backpack or accidentally bumped off the log from which I was operating, considerable damage may occur. Some say life is too short for QRP … I say life is too short worrying if my QRP transceiver will survive the rigors of a field outing.

Ham Radio Outlet <www.hamradio.com> is the authorized North American dealer for Laboratory 599. As of June 2021, HRO's price for the TX-500 was $900, but it was on backorder (due to ongoing pandemic delays). I can promise you, though, if you are in the market for a rugged QRP transceiver designed and built for field communications, the TX-500 is worth the wait.

– Until October, 73