

# Tortoise: Dual Band Transmitter



Berkeley Varitronics Systems' reptiles spread all around the world. Wireless industry operators, installers and consultants on every continent are using Gators™, Lizards™, Crocodiles™ and Dragons™. These portable RF transmitters range from 1mW all the way up to 45W, have high spectral purity, frequency agility and are offered in practically every frequency band of interest.

The newest addition to the BVS' family of reptiles is called Tortoise™, a dual channel transmitter. It shares the same philosophy as the rest of the products in the family – rugged, weatherproof housing, class A Power Amplification, adequate cooling and built-in VSWR antenna protection. Customers already expect accuracy of +/- 0.5 dBm and resolution of 0.1dB from Berkeley transmitters and Tortoise™ delivers nothing less.

There are, of course, new features, unique for the Tortoise. Two independent channels, each with output power up to 45 Watts (band dependent), open new horizons figuratively as well as literally. The coverage area increases substantially compared with a 5W dual band Dragon™. And the ability to transmit on two different frequencies offers a lot of flexibility comparing with the single channel Gator™. Many users will find it useful to drive-test two bands simultaneously for comparative studies of propagation on PCS and Cellular frequencies. Other users will take advantage of the two channel transmission with reduced time and cost of drive studies. And finally, most will feel it comforting and efficient to be able to use the same transmitter in the future for a different band instead of buying a new transmitter. Other useful features include the ability for Tortoise™ to re-transmit automatically if power is lost during transmission.

Other (less obvious to the user) advantages of the Tortoise are related to uses of modern components and new design ideas going on under the hood. The digital section is based on three processors; one providing user interfaces and the other two controlling corresponding RF channels. Communication between all three of them is maintained over a standard I2C bus. Such distribution of the computational



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and control functions simplifies coding and especially maintenance over time. If the past is any indication of the future, it is prudent to expect demand for new frequencies, channel spacing, etc.

Automatic adjustment of the offset and gain in the forward and reverse power measurement circuits is done using digital potentiometers and high resolution ADCs and DACs. This increases the dynamic range, accuracy and resolution of the measurements. At the same time it provides a basis for automatic calibration and production tests. Tortoise™ is calibrated at tenth dB resolution across all bands with both transmitters operating at this calibration level during typical use. Replacing the manual measurements and tuning with automatic calibration not only streamlines production but also improves reliability and quality of each transmitter.

Each transmission channel is equipped with voltage, current and temperature sensors. These parameters are monitored and used to control the cooling and protection circuitry. Should these sensors detect VSWR, current or operating temperature out of range, Tortoise shuts down automatically. They are also collected and stored to help with analysis of the working history and conditions when performing the scheduled and unscheduled maintenance.

Two more features need to be mentioned: transmitter remote control and modulation. Frequency and the power level for each channel can be set remotely, using either serial RS-232, USB or Ethernet ports. Of course parameters such as RF output levels and frequency adjustments can be directly entered using the top panel numeric keypad or dial knob but this can all be accomplished remotely using the aforementioned PC standards in conjunction with the supplied Tortoise™ PC control software. There is a provision for the addition of the digital, universal modulator board for each of the channel as well so BVS customers can instill their Tortoise™ with custom modulation schemes.