

## Technical Note: Obsolete WWVB Receivers

# Pending Changes in the WWVB Radio Signal Affects Precision Frequency and Timing Reference

Spectracom had used the WWVB signal to synchronize its time and frequency references and master clocks in North America before the wide-spread use of GPS for precision timing applications. The last of these WWVB products has not been promoted for over 10 years and officially went end-of-life in 2005.

A change in the WWVB signal was being considered in recent years to reduce impact of electro-magnetic interference and allowing for improved reception in consumer-grade clocks and watches<sup>1</sup>. However, this change affects the operation of precise time and frequency standards whose receivers are based on phase-locked loops, such as Spectracom WWVB receivers, so these products will not operate as intended.

This document summarizes the situation in a question and answer format. The recommendation is to remove any Spectracom WWVB receiver from service and replace it with a GPS-based synchronization system before July 2012.

Please call us at +1-585-321-5800 for more information.

### **Q: What is the WWVB signal?**

A: WWVB are the call letters of a radio station operated by the National Institute of Standards and Technology in Ft. Collins, Colorado that transmits a time and frequency standard over a low frequency signal. Spectracom manufactured WWVB receivers as a traceable source for frequency standards and/or time references (master clocks) for automatic synchronization of electronic equipment and computers; virtually any time-sensitive or frequency-stable device. The signal is also used to synchronize consumer-grade clocks and watches.

### **Q: Why is the WWVB signal changing?**

A: Despite increases in signal strength over the years, electro-magnetic interference, among other factors, affects the reliability of WWVB reception. A new protocol, based on a phase-modulation scheme, is being introduced at this time to improve signal reception, and is backward compatible with current generation consumer-grade radio-controlled clocks and watches<sup>2</sup>.

### **Q: So what is the problem with Spectracom WWVB receivers?**

A: Spectracom receivers extract the extremely stable carrier from the WWVB signal using a phase locked loop to discipline a local oscillator that serves as the basis for its precise frequency and timing functions. The new phase modulation does not allow carrier extraction in this way and therefore affects the ability of the receiver to decode time-of-day reliably.

### **Q: What Spectracom models are affected?**

A: The following models used a WWVB receiver and will no longer operate as intended as a result of the WWVB signal change.

<b>Model</b>	<b>Product Name/Type</b>
8160	Frequency Standard Receiver/Oscillator
8161	Frequency Standard Receiver/Oscillator
8163	WWVB Receiver/Phase Comparator
8164	Ageless Master Oscillator
8165	Ageless Master Oscillator
8170	Synchronized Clock
8171	Synchronized Clock
8182	NetClock/2 Master Clock

**Q: When is the change taking effect?**

A: NIST has already conducted testing of the new broadcast format starting 5pm MST Monday, March 5 and ending 5pm MST Saturday, March 10, 2012, as well as for additional shorter durations previously. More testing is likely. Check with the NIST web site for more information: <http://www.nist.gov/pml/div688/grp40/wwvb.cfm>. It is expected that the change will become permanent mid-summer 2012 (July or August)<sup>3</sup>.

**Q: How do I know if my Spectracom model is affected – what happens?**

A: All Spectracom WWVB receiver models are affected. Any models in current use will have triggered an “out-of-sync” condition during the testing between March 5 and March 10. This condition would be indicated on a front-panel LED, an electronic alarm signal, or in a log file (for those units with logging). When the unit is in the out-of-sync condition, the internal oscillator goes into free-run mode. The accuracy of the time and frequency signals will be degraded by the drift characteristics of the oscillator. In some cases, the unit can be configured to “squelch” output signals in the out-of-sync condition. In all cases, the time and frequency signals are no longer traceable to a standard.

**Q: What is the action required of users of the Spectracom models above?**

A: Contact Spectracom (tel +1-585-321-5800 or email [sales@spectracomcorp.com](mailto:sales@spectracomcorp.com)) to help assess your current need for precise time and frequency. In almost all cases, we can offer a drop-in replacement that uses a GPS receiver to provide the same signals as you currently use from the obsolete models.

**References:**

- [1] J.P. Lowe, “We Help Move Time through the Air”, Radio World, March 23, 2011, Vol. 35, No. 8 pp. 69, 70.
- [2] J. Lowe, et. al. “*New Improved System for WWVB Broadcast*”, 43rd Annual Precise Time and Time Interval Meeting, (see pgs 9-10 about WWVB as a precision frequency source).
- [3] Personal communication with John Lowe, NIST

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