High-Speed Measurement of RF Power Sweeps Optimize Data Throughput

by Richard Theiss, Applications Engineer, Boonton Electronics

Measuring sequential power readings in automated test systems of wireless devices where the power is discontinuous such as GSM or TDMA and the level is varied requires a peak power meter that can efficiently synchronize and store data. The 4530 series peak power meter from Boonton Electronics (Parsippany, NJ) now includes high speed measurements modes designed to optimize data throughput and reduce test time.

4530 Series

Wireless Power Sweep Test Applications

For testing of wireless devices such as cellular handsets, it is frequently necessary to verify the power control abilities of the transmitter over the full operating range of the product. Traditional power meters perform this test by incrementing the transmitter power, taking a filtered measurement and then querying the power meter to return the data to the host. This sequence of events is repeated for every power level of interest. For maximum test throughput, this sweep should be as short as possible, while still containing each power level to be verified. Traditional methods usually require step dwell times of up to several hundred milliseconds to allow for the combined latencies of the power step command, device-under-test, power meter, data network and host.

Programming the test device to perform a preset power sweep over a defined time interval is a faster solution, since it can eliminate two of these five latencies. Setting the power meter for a free-run mode and taking readings as fast as possible through the host as the sweep progresses will work only if the power meter, data network and host are fast enough to read the data in real time. If not, the dwell time at each step in the sweep will have to be increased until no readings are missed.

With many manufacturing test systems consisting of groups of instrumentation connected together through a data network (GPIB, LAN or other type), things can get very busy during high-speed, high-volume testing. In the case of fast instruments such as the Boonton 4530 series, the measurement rate of test instruments is usually more than sufficient to gather the test data in the required time, but often exceeds the ability of the data network to read and store the data in real time. When this happens, measurements may be lost, and the host controller will not record all readings taken by the instrument. Often the only choice is to increase the test time so the controller can keep up.

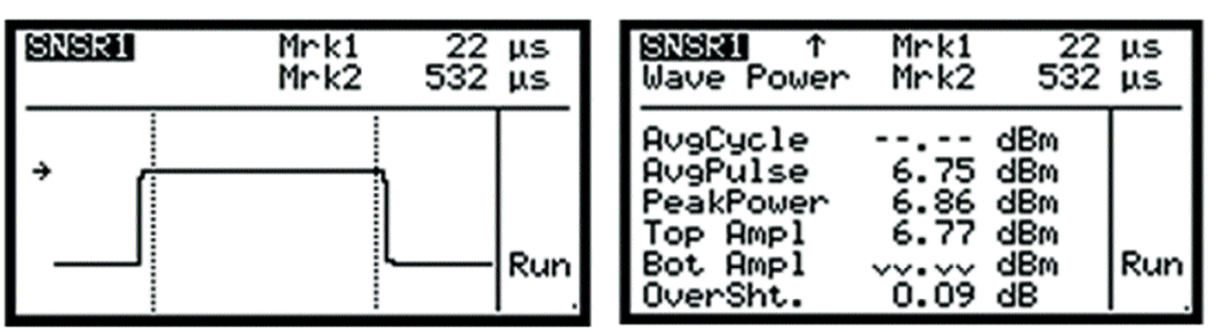

Figure 1: 4530 Series Display of the Active Portion of a Single GSM Timeslot

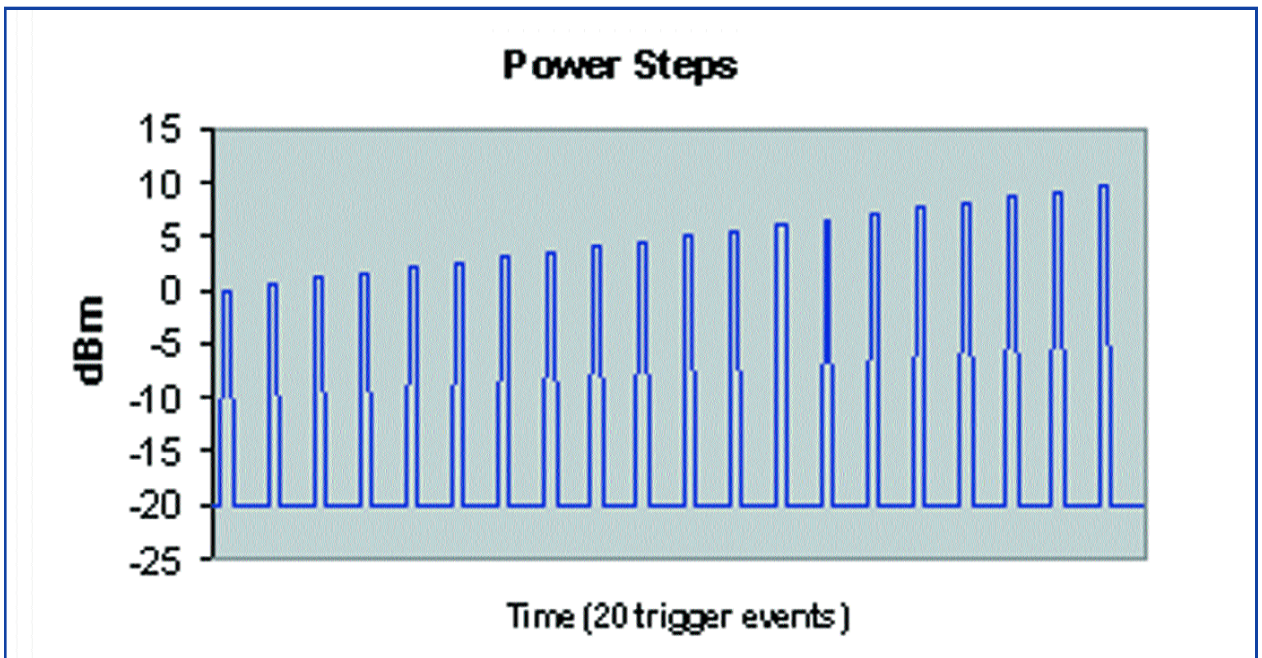

Figure 2: Measurement Setup of Pulse Power Step

There are several ways to avoid these problems. First, the measurements may be processed by the instrument to yield a reduced number of values, which reduces the demands on the data network and host controller. A second technique is to save all the measurement values in onboard instrument memory and read them back at whatever rate the data network can handle. These two methods may be combined to further reduce the amount of data to a manageable size.

For fastest testing, it is desirable to reduce dwell time at each step to the minimum required for the power meter to achieve a stable reading. Storing the readings onboard the instrument as the sweep occurs, then transferring an array of readings can do this. In this way, interruptions due to controller and data network latency will not affect the integrity of the sweep measurement. Optimum test throughput is achieved through combination of buffered measurements and peak power sensors inherently fast settling time.

The Boonton 4530 series RF Power Meter now includes operating modes that save power readings into a memory buffer and this feature is especially useful for high-speed production test applications. These modes allow the user to store sequential power readings into an onboard memory buffer as they become available and then read the complete buffer from the instrument into the control system after the acquisition is complete.

High-Speed Measurements in Pulse Triggered Mode

Triggered pulse measurements may be buffered to record power sweeps for discontinuous formats such as GSM or TDMA. When measurements are buffered in the pulse mode, the power meter saves one reading into the buffer each time a pulse triggers the meter. The 4530 series' powerful triggering features allow synchronization with most types of pulse and burst modulation formats. Each reading consists of the average power between the two on-screen time markers (cursors), so the buffer will contain a sequence of readings, which represent the average power of each individual pulse in a burst sequence.

The standard GSM signal uses a digitally modulated burst to transmit data. Each user is allocated of eight timeslots and must transmit within its assigned timeslot. The 4530 series peak power meter has two programmable cursors allowing power measurements on the active portion of each timeslot, while excluding the transition time intervals.

If the power is increased for each pulse, the buffered data array will contain one power reading for each power increment. This can be far faster than recording thousands of data points and analyzing the step increases offline.

Buffered measurements in the pulse mode can also be used with a continuous power sweep, rather than pulses, if an external trigger pulse is supplied for each power step. This is used to synchronize the acquisition with the steps and ensure that each power reading takes place when the device's power is properly settled. Absolute timing of the synchronization pulses is not critical – they merely need to be repeatable.

Note that in pulse mode, each buffer entry corresponds to the power between markers for a single trigger event. If averaging is set to greater than one, or the timespan is set to faster than 50us, each reading will be a weighted average of the current pulse and past pulses. It is also important to consider that the power meter has a re-arm time of 2 to 3 milliseconds at the end of each sweep, or some pulses of the next sweep may be missed.

GSM timing generally have pulse repetition periods longer than 3 milliseconds and should not present a problem, but signals with pulse periods less than about 3 to 4 milliseconds may skip pulses.

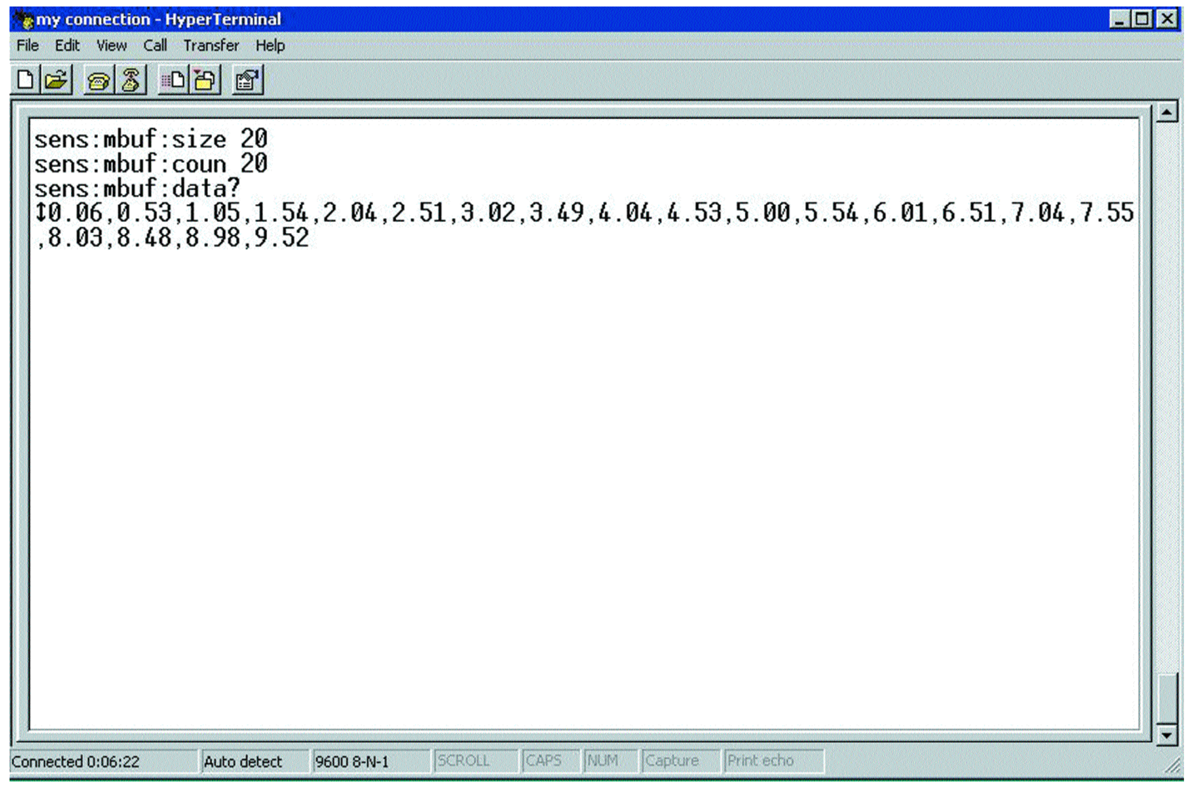

Figure 3: High-speed Measurement Commands, Queries and Results

Power Step Measurement (Pulse Mode) Example

In **Figure 2 (pg 1)** the level of the GSM pulse was increased in twenty steps. The RS232 utility program Hyper-Terminal was used to set up the high-speed measurement for buffered memory operation using two simple commands and the average power measurement results of all twenty steps were read-back using a single query.

High-speed measurement of RF power sweeps may also be set to free-run measurements in CW or modulated modes to be stored ("buffered") at various pre-programmed rates up to 500 readings per second. Up to 4000 measurements per channel may be saved and then read by the host. This allows the user to trade off between time resolution, measurement duration and data set size. This mode is best for continuous modulation formats where the power is stepped at periodic time intervals.

High-speed measurements of RF power sweeps is a standard feature of the Boonton 4530 series peak power meter and can be added to instruments already in service via software update available in the service and support section of www.boonton.com.

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Boonton (A Wireless Telecom Group Company)
25 Eastmans Road
Parsippany, NJ 07054
P: +1 (973) 386-9696
F: +1 (973) 386-9191
E-mail: boonton@boonton.com
Web site: www.boonton.com