Legacy Frequency Counters Self-Check Interpretation

There was a YouTube video I was watching recently where a self-check was done on a HP frequency (electronic) counter. He mentioned how accurate it was by performing a self-check and indicating it was displaying the correct frequency. This interpretation of the displayed frequency is wrong. This interpretation seems to be quite common.

HP 5245L Electronic Counter in Check Mode

The self-check tests the decade counters and various other things but not the accuracy of the counter. The reason being is that the reference frequency for the self-check is the same one that controls the gate. Let's say the frequency counter uses a 10 MHz reference oscillator. If the reference oscillator is right on frequency the displayed frequency is likely correct. If the reference oscillator is say 20 Hz low and a self-check is done the display would still indicate 10.000000 MHz. What is happening is that the lower frequency is extending the gate time to where the counter still indicates 10.000000 MHz.

BTW: the gate opens the door to the frequency you are counting. For example if you are counting 10 MHz the gate might pass that frequency for one second (depending what it's set for) and allows the decade counters to count for one second and then the door is closed. The 10 MHz is then displayed. Newer counters might do this differently.

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