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.

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 duration. 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 and the counter still indicates 10.000000 MHz. The reference oscillator and the gate time are in step. It takes so many fixed steps (divisions) to determine the gate time. If the reference frequency is off so will the gate time.

BTW: the gate opens the door to the frequency you are counting. For example if you are counting 5 MHz the gate might pass the frequency you are counting for one second (depending what it's set for) and then the door is closed. The 5 MHz is then displayed. The gate time can be changed in some counters for example between 10, 1 and .1 seconds. Newer counters might do the above process differently.

The reference frequency for the self-check for newer counters is likely the same that controls the gate also therefore the same interpretation error applies.

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