

# Setting Up External LOs for 10 MHz Absolute Phase Noise Measurements

**Application Note / 2026-07-01**



## Overview

This note covers best practices for configuring external local oscillators (LOs) when performing absolute phase noise measurements at 10 MHz. Following these guidelines will help avoid measurement errors related to LO range detection and will improve measurement reliability, particularly when using narrow-tuning 10 MHz OCXOs as external references.

## Why External LOs Are Used for Absolute Measurement

In an absolute phase noise measurement, the analyzer needs a stable, independently tunable reference against which to compare the device under test (DUT). External LOs allow the analyzer to track and lock to the DUT frequency across small variations, which is especially important at 10 MHz where DUT and reference frequencies are very close together and any drift between them must be actively compensated.

### Typical Setup

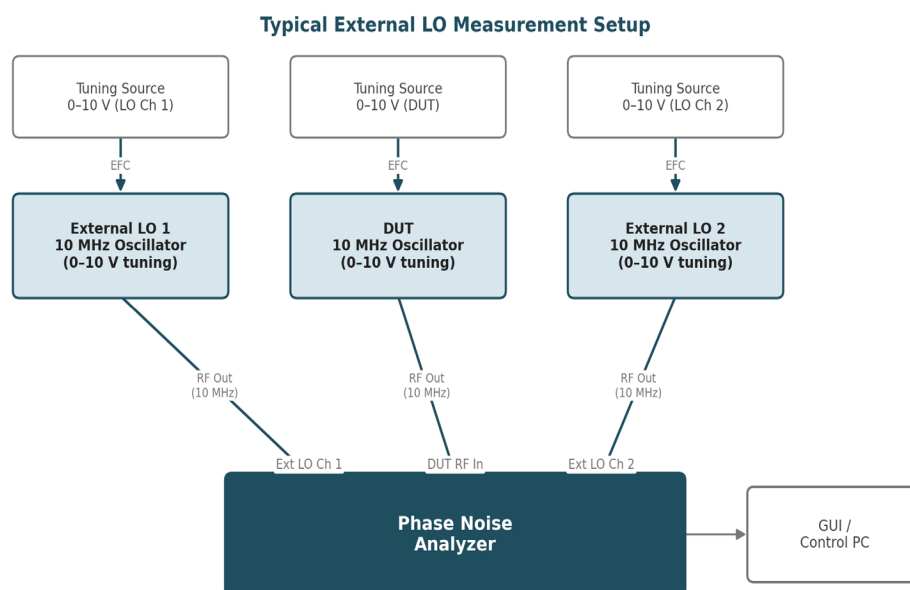


Figure 1. DUT and external LO oscillators (each with independent 0–10 V tuning) feeding the phase noise analyzer.

## Calibrating External LOs

Before running a measurement, each external LO channel must be calibrated across its tuning voltage range. This calibration builds a voltage-to-frequency table that the analyzer uses to track the DUT during measurement. Two channels are required for the cross-correlation measurement; calibrate both (with no DUT attached) before proceeding.

## Important: Know Your OCXO's Tuning Sensitivity

Not all 10 MHz OCXOs tune the same way. Some have a wide pulling range (many Hz or more per volt), while others — particularly many 10 MHz OCXOs used as precision references — have a very narrow tuning range, sometimes on the order of only 1–3 Hz per volt across their entire 0–10 V control range. This is normal behavior for these devices, but it has a direct impact on how the LO calibration table should be used.

Before calibrating, it is worth quickly checking (or requesting from the oscillator's datasheet) the approximate frequency pulling range across the full tuning voltage. If the total span is only on the order of tens of Hz, treat the oscillator as narrow-tuning and follow the guidance in next section closely.

## Best Practice: Center the DUT Frequency Within the LO Calibration Range

After calibrating the external LOs, the DUT frequency should fall as close as possible to the middle of the calibrated tuning range — not near either extreme. As a practical guideline, aim to keep the DUT's corresponding tuning point within the middle third of the calibrated range (for a 0–10 V calibration, roughly the 4–6 V region).

1. Calibrate the external LOs across their full tuning range as usual.
2. Before running the measurement, check or adjust the DUT's tuning so its frequency corresponds to a point near the center of the calibrated LO range, rather than near 0 V or full-scale.
3. If the DUT cannot be adjusted, consider narrowing the LO calibration range so that it is centered on the DUT's actual operating frequency, rather than calibrating the full 0–10 V span.

This margin matters most for narrow-tuning oscillators, where the entire calibrated frequency span may only be tens of Hz wide — leaving little room for normal short-term frequency variation if the DUT sits right at the edge of that span.

## Troubleshooting: “DUT Frequency Outside Range of External LOs”

If this error appears, even though the DUT frequency appears to fall within the calibrated LO range:

- > Set the frequency counter interval to its maximum available value (typically 10 seconds) in the Inputs menu, if not already set.
- > Re-check where the DUT frequency falls within the LO calibration table. If it is near either edge, this is the most likely cause.
- > Re-tune the DUT, or re-calibrate the LOs over a narrower range centered on the DUT frequency, so the operating point sits near the middle of the calibrated span.
- > Recalibrate the LOs after making either adjustment, then re-run the measurement.

If the error persists after centering the DUT frequency within the calibrated range, contact Maury Microwave applications support with your calibration table and OCXO tuning specifications for further assistance.

## Quick Checklist

- > Confirm OCXO tuning sensitivity (Hz/V) before calibrating, especially for 10 MHz references.
- > Calibrate both external LO channels across an appropriate tuning range.
- > Position the DUT frequency near the center of the calibrated LO range — avoid the extremes.
- > Set frequency counter interval to maximum for best measurement stability.
- > If errors occur, re-center the DUT frequency (or re-calibrate around it) before assuming a hardware fault.

## Support

For additional assistance with external LO setup or absolute measurement configuration, contact Maury Microwave support.



#### **Application Note / 2026-07-01**

© 2026 Maury Microwave. All Rights Reserved.

Specifications are subject to change without notice.

Maury Microwave is AS9100D & ISO 9001:2015 Certified.

#### **CONTACT US:**

W / [maurymw.com](http://maurymw.com)

E / [maury@maurymw.com](mailto:maury@maurymw.com)

P / +1-909-987-4715

F / +1-909-987-1112

2900 Inland Empire Blvd

Ontario, CA 91764