



TECHNICAL
OVERVIEW

Functional Test for Keysight Power Sensors

Calibration Factor Deviation Test

Keysight Technologies has added a new functional test to power sensor calibrations. The “Calibration Factor Deviation” test compares the new calibration factors to the previous calibration factors. This functional test does not change the current performance verification test or product specifications.

As part of a global quality initiative, Keysight collected customer feedback and reviewed measurement data from customer and Keysight calibration labs. To improve power sensor calibration quality, the new functional test measures the calibration factor deviation between periodic calibrations, then compares it to the maximum uncertainty specified in the power sensor data sheet.

Understanding calibration factors

Calibration Factor (CF) corrects for the difference between the power meter's measured power and the incident power at the port. It is a combination of the reflection coefficient and the effective efficiency (losses besides reflection):

$$P_i = P_m / CF \text{ assumed source reflection} = 0$$

$$P_i = \text{power incident}, P_m = \text{power measured}$$

$$CF = \eta_e (1 - \rho_i^2)$$

η_e = effective efficiency

ρ_i = sensor reflection coefficient



Calibration factor deviation limits

To help power sensor users obtain the best possible measurements, Keysight checks the difference between CF measurements. The new functional test compares the CF measurement results between periodic calibrations, which should be performed at a maximum recommended interval of one year. It uses the uncertainty of the difference of the two measurements as the comparison limits for judging success or failure which would entail the RSS of the two relative uncertainties of the two tests:

$$\frac{|CF_1 - CF_2|}{CF_1} * 100 \leq \sqrt{2} * U_{max}$$

The functional test assumes that there is no correlation between the two measurements and that the uncertainty value (which is the maximum uncertainty from the data sheet, not the measurement uncertainty) is the same for both, which results mathematically in a test limit of $\sqrt{2} * U_{max}$.

Calibration factor deviation test results

The functional test result will be reported as **As Expected**, **Not As Expected**, or **Not Tested**:

- **As Expected** – The new calibration factors are within the test limit of the previous calibration factors.
- **Not As Expected** – One or more of the new calibration factors are larger than the test limits of the previous calibration factors.
- **Not Tested** – The previous calibration factors were not available, the previous calibration factors were not applicable due to repair activity done on the unit, or the previous calibration was performed at a different power level.

If the test result is **Not As Expected**, users will have two options:

- Accept the new calibration factors, and the power sensor is returned with no further testing.
- A core assembly replacement can be requested for an additional charge. The power sensor is re-calibrated, then returned with a new set of calibration factors.

Please note that there are several factors that contribute to the total power measurement uncertainty of a test system. All these factors should be included together when assessing the measurement accuracy. Find more details about power measurement uncertainty in the application notes below:

- [Fundamentals of RF and Microwave Power Measurements \(Part 3\)](#)
- [Solutions for Minimizing Measurement Uncertainty and Estimating Uncertainty Due to Mismatch](#)
- [Four Steps for Making Better Power Measurements](#)

Implementation Schedule

The “Calibration Factor Deviation” test is being phase implemented and, as of May 1, 2021, is added to the following power sensor models:

- U2000A/B/H, U2001A/B/H, U2002A/H, U2004A
- E9300A/B/H, E9301A/B/H, E9304A
- E9321A, E9322A, E9323A, E9325A, E9326A, E9327A
- E4412A, E4413A (only if the previous calibration was performed at the same power level)
- U8481A, U8485A, U8487A, U8488A
- N8481A/B/H, N8482A/B/H, N8485A, N8487A, N8488A, N8486AQ/AR
- 8481D, 8483A, 8485D, 8487D
- W8486A, V8486A, E8486A
- N5532B, U5532C

This test will be added to other Keysight power sensors in the future.

Conclusion

For questions on the “Calibration Factor Deviation” functional test you can contact Keysight’s Technical support team. Please visit www.keysight.com/find/support and click on “Visit Keysight Product Support”.



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