

PM Series Microwave Power Calibration System



- Supports Sensors from most major manufactures up to 50 GHz
- Faster than direct compare method
- Lowest total uncertainty
- National Metrology Institute class thermistor reference standard

The PM Series calibrator simplifies the tedious and complex process of RF power sensor calibration. The goal is to realize consistent, cost effective and traceable calibrations. However, the manual approach is very demanding of even the most experienced technician.

A successful calibration involves:

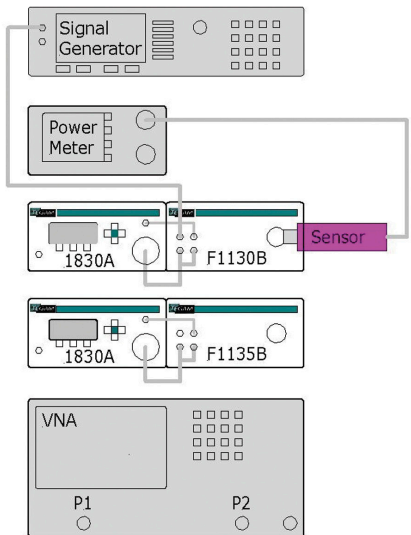
- Setting instruments
- Keeping track of standards
- Computing mismatch (Γ)
- Computing calibration factors (k)
- Computing total uncertainties
- Programming EPROM sensors
- Generating reports and labels

The PM Series automates and standardizes this process while providing compatibility with a wide variety of instruments and power sensors.

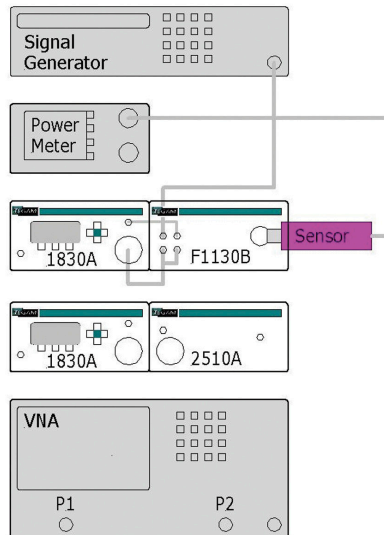
The PM Series is built upon the 1830A metrology grade RF Power Meter. This is the only RF Power Meter on the market that is compatible with all known types of thermistor sensors including TEGAM, Agilent, Weinschel, Hughes and Millitech.

A new line of compatible RF power thermistor transfer and reference standards have also been developed that provide flexibility and expandability as your RF calibration needs grow. These standards are based on the same time proven method used by NIST, PTB, NIM and other national metrology organizations around the world.

26 GHz System



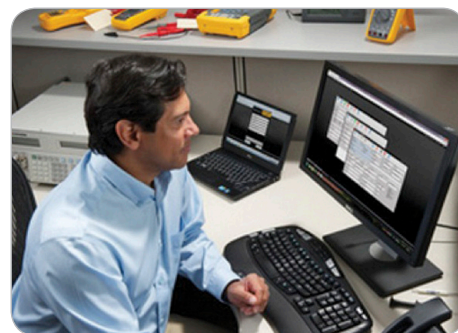
50 GHz System



Expand the workload of MET/CAL® Calibration Software to microwave power sensors

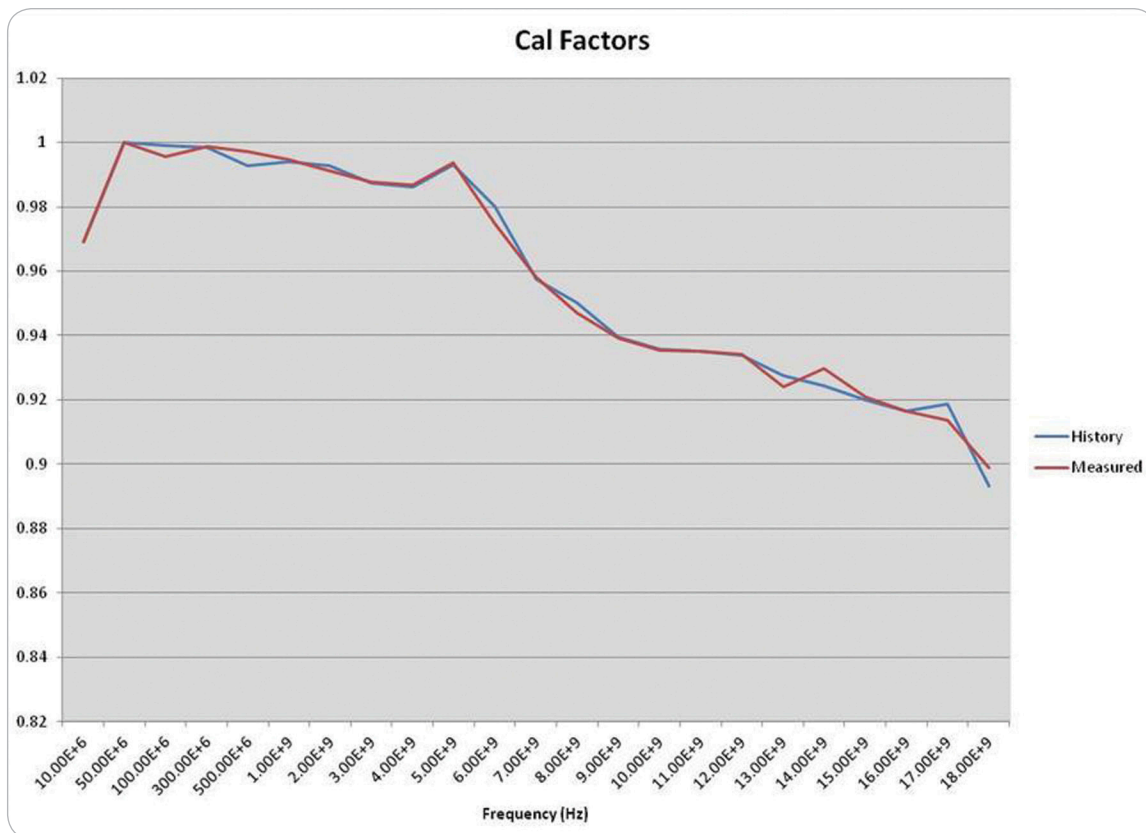
Correctly calibrating an RF power sensor is an involved process that requires numerous complex calculations of calibration factor, mismatch correction and uncertainty. MET/CAL® Software now supports this complex process with an advanced set of procedures for the major manufacturers of microwave power sensors. Fully auditable and transparent calculations are accomplished with an Excel® spreadsheet making it easy to deploy by organizations who are ISO 17025 accredited. Combined with MET/CAL® Software's industry leading features of test and measurement asset tracking and report generation, it is the preferred option for those who need to automate microwave sensor calibration.

- Fully automated RF power sensor calibration
- VNA support for automated S11 parameter measurements
- Upload and download EPROM data of many popular Agilent, Anritsu and Rohde & Schwarz power sensors
- Support most major networks analyzers and signal generators
- Track asset information including calibration and maintenance history and status, traceability, users, customers, and location.
- Preserve calibration history in the MET/TEAM® or MET/TRACK® databases
- Dynamic Uncertainty Calculations
- Analyze and report asset information; produce customized printed certificates and reports.
- Make data available to other corporate systems.
- Import asset and calibration data into MET/CAL® Software
- Help meet the requirements of quality standards like ISO 9000, ISO/IEC 17025, NRC 10 CFR, ANSI Z540.3, and others.



	A	C	D	E	F	G	H	I	J	K	L	M	N
1	Frequency	Uncertainty of Standard Cal factor in mW/mW, k=1	Magnitude of splitter match as voltage reflection factor	Uncertainty of Magnitude of splitter match, as change in voltage reflection factor (not percentage), k=1	Phase in degrees of splitter equivalent match	Real-axis component of Gamma_G	Imaginary-Axis component of Gamma_G	Magnitude of DUT voltage reflection factor	Uncertainty of magnitude of voltage reflection factor, in V/V, NOT dB or percent, k=1	Phase in degrees of DUT voltage reflection factor	Real-axis component of Gamma_DUT	Imaginary-Axis component of Gamma_DUT	Match Correction Factor from equation (5), The part in parentheses that multiplies the "raw" cal factor.
2	Input	Input	Input	Input	Input	Calc	Calc	Input	Input	Input	Calc	Calc	Calc
3	Freq_	U_k_s	rho_g	U_rho_g	phi_g	x_g	y_g	rho_l	U_rho_l	phi_l	x_l	y_l	Match_
6	50.00E+6	0.0032	0.0031	0.014	168.57	-0.00303852	0.00061433	0.31	0.007	1	0.30995279	0.00541025	1.00189117
7	100.00E+6	0.00305	0.0029	0.014	148.44	-0.00247107	0.00151783	0.078	0.007	1	0.07798812	0.00136129	1.00038961
8	300.00E+6	0.0031	0.0028	0.014	104.86	-0.00071808	0.00270635	0.047	0.007	1	0.04699284	0.00082026	1.00007195
9	500.00E+6	0.0031	0.0034	0.014	82.4	0.00044967	0.00337013	0.047	0.007	1	0.04699284	0.00082026	0.99996329
10	1.00E+9	0.00315	0.0049	0.014	45.07	0.00346059	0.00346905	0.047	0.007	1	0.04699284	0.00082026	0.9996805
11	2.00E+9	0.00315	0.0068	0.014	-13.75	0.00660513	-0.00161626	0.047	0.007	1	0.04699284	0.00082026	0.99937666
12	3.00E+9	0.00325	0.0037	0.014	-113.77	-0.00149134	-0.00338613	0.069	0.007	1	0.06898949	0.00120422	1.00019768
13	4.00E+9	0.00335	0.0097	0.014	-179.59	-0.00969975	-6.9411E-05	0.069	0.007	1	0.06898949	0.00120422	1.00133864
14	5.00E+9	0.0035	0.013	0.014	133.76	-0.00899131	0.00938916	0.069	0.007	1	0.06898949	0.00120422	1.00126403
15	6.00E+9	0.00355	0.0117	0.014	113.94	-0.00474762	0.01069346	0.069	0.007	1	0.06898949	0.00120422	1.00068148
16	7.00E+9	0.00355	0.0118	0.014	104.86	-0.00302621	0.01140535	0.069	0.007	1	0.06898949	0.00120422	1.00044568
17	8.00E+9	0.0035	0.0131	0.014	83.8	0.00141479	0.01302338	0.069	0.007	1	0.06898949	0.00120422	0.99983697
18	9.00E+9	0.0036	0.0101	0.014	42.79	0.00741187	0.00686106	0.069	0.007	1	0.06898949	0.00120422	0.99899433
19	10.00E+9	0.0036	0.0045	0.014	-43.91	0.00324194	-0.00312087	0.069	0.007	1	0.06898949	0.00120422	0.99954526
20	11.00E+9	0.0036	0.0085	0.014	-175.66	-0.00847563	-0.00064324	0.069	0.007	1	0.06898949	0.00120422	1.00116825

Excel Based Calculation Engine



	Signal Generators ⁱ	Network Analyzers ⁱⁱ	Microwave Standards
100 KHz to 18 GHz	Anritsu MG3692C Fluke 96270A Gigatronics 2520B Keysight N5173B-520 R&S SMF 100A	Anritsu MS4642B R&S ZVA Series Keysight N5232A ⁱⁱⁱ HP 8510C ⁱⁱⁱ	1830A with F1130B
100 KHz to 26.5 GHz	Anritsu MG3693C Fluke 96270A Gigatronics 2526B Keysight N5173B-532 R&S SMF 100A	Anritsu MS4644B R&S ZVA Series Keysight E5063A, N5242A ⁱⁱⁱ HP 8510C ⁱⁱⁱ	1830A with F1130B 1830A with F1135B
100 KHz to 50 GHz	Anritsu MG3695C Gigatronics 2550B Keysight E8257D-550	Anritsu MS4645B R&S ZVA Series Keysight E5063A, N5245A ⁱⁱⁱ HP 8510C ⁱⁱⁱ	1830A with F1130B 1830A with 2510A

i Any SPCI compliant signal generator can be utilized, the procedures allow for use up to two signal sources per procedure, including function generators. However, this list consists of the specifications of both power and frequency requirements.

ii VNA calibration kits consist of Open, Short, Low Band Load, and Sliding Load.

iii Keysight PNA Series and HP8510C do not operate down to 100 kHz.

Uncertainty Calculation for a Power Sensor Calibration

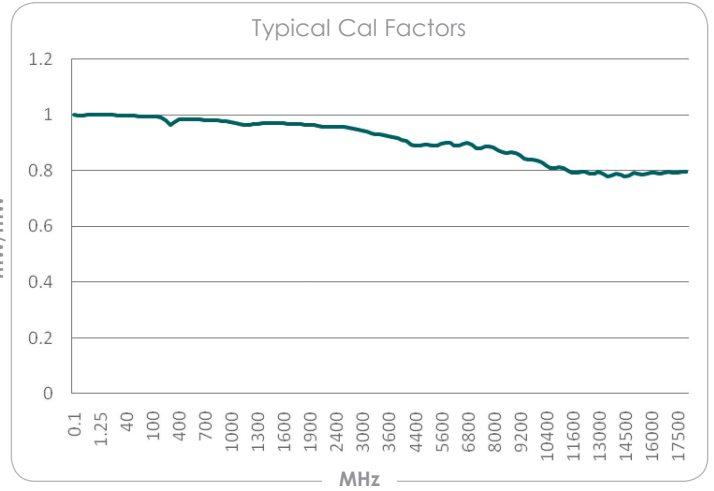
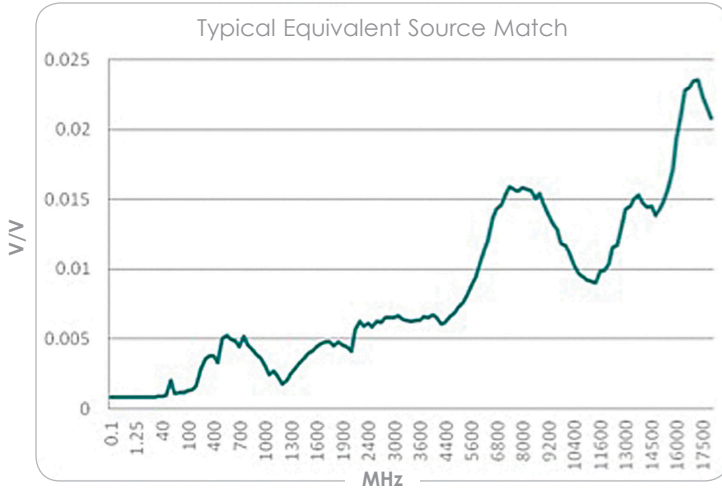
Example calibration: Frequency: 18 GHz
Power: 1 mW

$$k_{DUT} = \frac{P_{DUT}}{P_{FT_{z0}}} (|1 - \Gamma_{FT} \Gamma_{DUT}|^2)$$

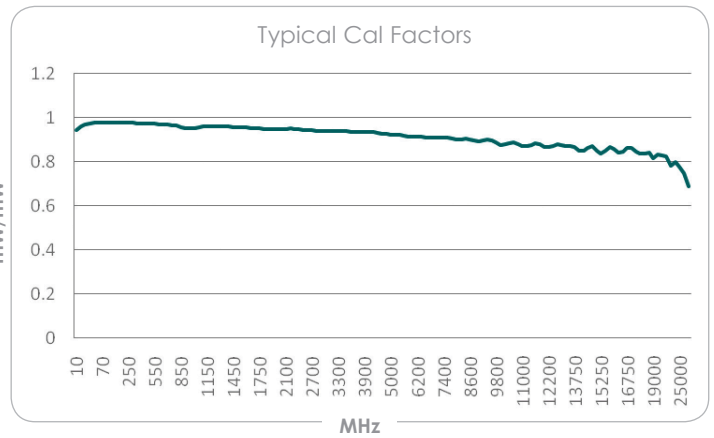
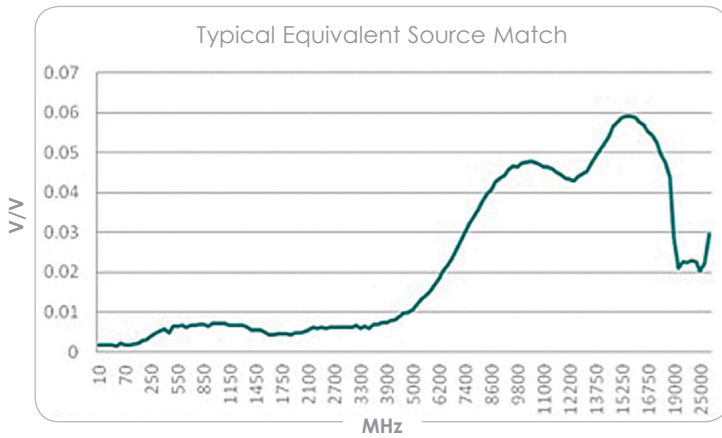
Input Component	Value of Input	Uncertainty of Input Value	Uncertainty Contribution to k of Input
F1130B calibration factor	.8851 mW/mW	.01 mW/mW	.01 mW/mW
F1130B Rho	.042 V/V	.03 V/V	.00114 mW/mW
F1130B Phi	-41.8 degrees	8 degrees	.00111 mW/mW
1830A Power Reading	1.0000 mW	.07% of rdg	.00059 mW/mW
DUT Rho	.111 V/V	.03 V/V	.00014 mW/mW
DUT Phi	120 degrees	4 degrees	.00055 mW/mW
DUT Power Reading	1.0050 mW	.5% of rdg	.00431 mW/mW
Repeatability	.002 mW/mW		.002 mW/mW
RSS Uncertainty			.0113 mW/mW

Performance Graphs

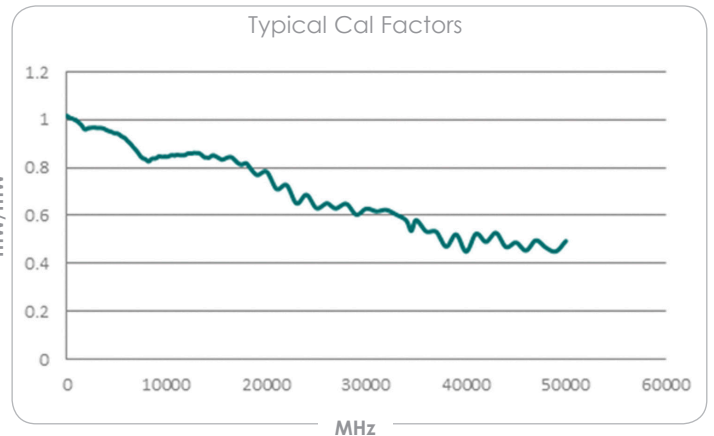
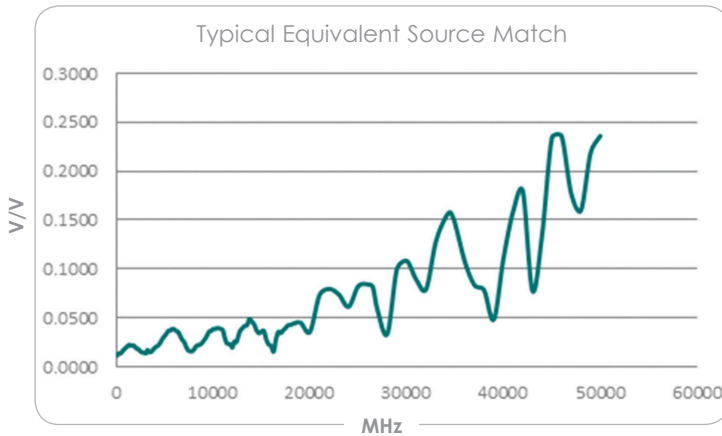
F1130B



F1135B



2510A



PM Series Supported Sensors

SENSOR	FREQUENCY RANGE	POWER RANGE	EEPROM Read	EEPROM Write
ANRITSU				
MA2442A	10 MHz to 18 GHz	-67 dBm to 20 dBm	Yes	Yes
MA2442D	10 MHz to 18 GHz	-67 dBm to 20 dBm	Yes	Yes
MA2445A	10 MHz to 50 GHz	-67 dBm to 20 dBm	Yes	Yes
MA2472A	10 MHz to 18 GHz	-70 dBm to 20 dBm	Yes	Yes
MA2472D	10 MHz to 18 GHz	-70 dBm to 20 dBm	Yes	Yes
MA2475A	10 MHz to 50 GHz	-70 dBm to 20 dBm	Yes	Yes
MA2475D	10 MHz to 50 GHz	-70 dBm to 20 dBm	Yes	Yes
MA24002A	10 MHz to 18 GHz	-30 dBm to 20 dBm	Yes	Yes
MA24005A	10 MHz to 50 GHz	-30 dBm to 20 dBm	Yes	Yes
MA2445D	10 MHz to 50 GHz	-67 dBm to 20 dBm	Yes	Yes
KEYSIGHT				
8481A	10 MHz to 18 GHz	-30 dBm to 20 dBm	NA	NA
8482A	100 kHz to 4.2 GHz	-30 dBm to 20 dBm	NA	NA
8485A	50 MHz to 26.5 GHz	-30 dBm to 20 dBm	NA	NA
8487A	50 MHz to 50 GHz	-30 dBm to 20 dBm	NA	NA
E4412A	10 MHz to 18 GHz	-70 dBm to 20 dBm	Yes	Yes
E4413A	50 MHz to 26.5 GHz	-70 dBm to 20 dBm	Yes	Yes
E9300A	10 MHz to 18 GHz	-60 dBm to 20 dBm	Yes	Yes
E9301A	10 MHz to 6 GHz	-60 dBm to 20 dBm	Yes	Yes
N1921A	50 MHz to 18 GHz	-35 dBm to 20 dBm	Yes	No
N1922A	50 MHz to 40 GHz	-35 dBm to 20 dBm	Yes	No
U2000A	10 MHz to 18 GHz	-60 dBm to 20 dBm	Yes	No
U2001A	Modified 10 MHz to 6 GHz	-60 dBm to 25 dBm	Yes	No
U2002A	50 MHz to 24 GHz	-60 dBm to 20 dBm	Yes	No
ROHDE & SCHWARZ				
NRP-Z51	DC to 18 GHz	-30 dBm to 20 dBm	Yes	Yes
NRP-Z52	DC to 27 GHz	-35 dBm to 20 dBm	Yes	Yes
NRP-Z56	DC to 50 GHz	-35 dBm to 20 dBm	Yes	Yes
TEGAM				
F1130	100 kHz to 18 GHz	-20 dBm to 13 dBm	NA	NA
F1135	10 MHz to 26.5 GHz	-20 dBm to 13 dBm	NA	NA
2510A	10MHz to 50 GHz	-20 dBm to 14 dBm	NA	NA