USER GUIDE

WR62 Waveguide SSLT Calibration Kit

12.4 – 18.0 GHz

Models: WR62CK10\12 Series

Maury Microwave

8770-512 (Rev A) 03/16

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Warranty

Maury Microwave hardware products are warranted against defects in materials and workmanship for a period of one year from date of shipment. During the warranty period, Maury Microwave will, at its option, either repair or replace products which prove to be defective.

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GENERAL INFORMATION

Calibration Kit Description

The WR62CK10\12 series of waveguide SSLT calibration kits are designed to provide accurate calibrations of network analyzers in the WR62 band of 12.4 – 18.0 GHz. Each of these kits includes all the necessary SSLT calibration standards and associated hardware needed for the accurate calibration of most network analyzers.

See the following *Calibration Kit Contents* section for information on included components and available kit options.

NOTE: This document, calibration constants software, and data sheet can be downloaded from our website: ***maurymw.com***

NOTE: Legacy analyzer software is not on our website but is available for purchase.

Maintenance

This calibration kit is relatively maintenance free if the components are handled with the same care that is appropriate to all precision equipment. As with any precision component, proper care should be taken to assure clean mating surfaces, correct alignment when mating, and proper torquing of connectors or waveguide coupling screws. To help maintain the integrity of the components in this kit, routine visual inspection and cleaning of mating surfaces is recommended. Failure to do so may result in degraded repeatability and accuracy, as well as damage any mated devices.

Calibration

To maintain verification that a calibration kit is performing to traceable specifications, we recommend that all kits be periodically returned to Maury Microwave for calibration. The typical calibration cycle is one year, although actual need may vary depending on usage.

Supporting Test Port Adapters

When configuring a test setup, be sure that damaging stresses are not applied to the connectors on the test set. This is particularly critical when the attached components are heavy or long. Always properly support the test port adapters being used.

Electrostatic Discharge Precautions

Protection against electrostatic discharge (ESD) is essential while inspecting, cleaning, or making connections to connectors attached to a static-sensitive circuit, such as those found inside test sets.

When handling the connectors on the test set, be aware that you are coming in contact with exposed center conductors that are connected directly to the static-sensitive internal circuits of the network analyzer. Make sure that you and your equipment are well-grounded before inspecting, cleaning, or making connections to test set ports. Standard ESD precautions, such as the use of grounded wrist straps and grounded antistatic mats, are recommended.

Waveguide Flange Description

All calibration standards and verification devices in the WR62 series kits utilize the Maury Microwave Precision WR62 MPF62. This flange design is mateable with the standard UG419/U flange, yet it provides a dramatic improvement in flange connection consistency, repeatability, and flange serviceability over the UG419/U design. These flanges incorporate two precision indexing holes and utilize slip fit indexing pins that provide the precise mating alignment required for consistent repeatable connections. Each kit includes a set of hex head bolts, hex nuts and indexing pins. The indexing pins are provided in two lengths. The long indexing pins are generally easier to use, but the short pins are also included for use in tight access situations or when it is intended that the pins be left in the flange coupling.

Refer to Maury Microwave data sheet 5E-008 (available on our web site) for further specifications on the Maury Microwave Precision WR62 MPF62.

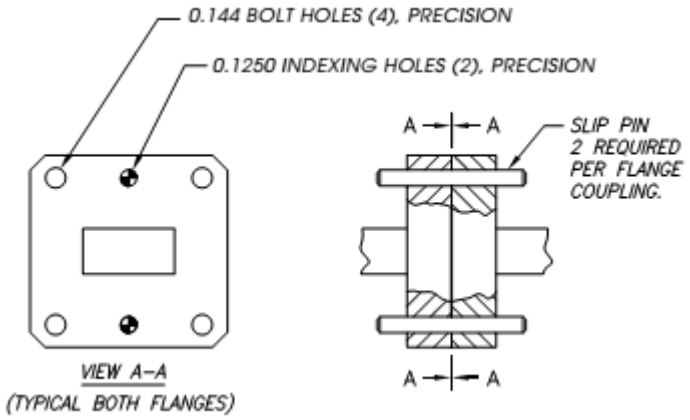

Figure 1. Flange with Indexing Pins

Waveguide Flange Care

Waveguide flanges should be inspected prior to each use. For optimum results, they should be free of any imperfections, scratches, nicks, dirt, etc. When not in use, flanges should be covered with a protective flange cover.

Should a flange's mating surface become damaged, it should be repaired immediately before it is used any further.

Using Your Verification Devises

An easy way to check that your calibration went well is to measure source match. During each of the calibration methods, a short circuit was connected to the test port(s). Following calibration, if the short circuit is reconnected to the test port and the analyzer is set to measure S11 (displayed in dB), we'd expect to see a straight line with very little loss. If we inserted a straight section between the short and the test port, we'd expect to see a straight line with more loss, with the loss increasing with frequency. What you will actually see is some ripple caused by the residual reflections of the test port interacting with the reflections from the short. This ripple shows the combined effects of both source match and directivity. The amount of ripple usually ranges from 0.02 dB peak-to-peak (a very good calibration) to 1 dB peak-to-peak (not a very good calibration).

Source match can be measured as follows:

a. Connect the straight section to the measurement port, terminated with the appropriate flat short.

b. Measure the return loss and adjust the scale resolution to detect the ripple pattern on the Return Loss display (typically 0.1 - 0.2 dB, peak-to-peak).

c. Measure the peak-to-peak amplitude of the ripple pattern. To adjust for slope, measure two peaks on each side of a valley and average.

d. Use **Table 1** to convert peak-to-peak ripple to source match.

Calibration Kit Contents

Standard Components – WR62CK10		
1 ea	Fixed Offset Short (1/8 λ)	P340A1
1 ea	Fixed Offset Short (3/8 λ)	P340A2
1 ea	Fixed Termination	P301A
1 ea	Hardware Kit	WR-1-6
1 ea	Indexing Pin Kit	WR-2-3
1 ea	Instrument Case	

Standard Components – WR62CK12		
1 ea	Fixed Flush Short	P344A
1 ea	Fixed Offset Short (1/8 λ)	P340A1
1 ea	Fixed Offset Short (3/8 λ)	P340A2
1 ea	Fixed Termination	P301A
1 ea	Straight Section (5 cm)	P103A5
1 ea	Hardware Kit	WR-1-6
1 ea	Indexing Pin Kit	WR-2-3
1 ea	Instrument Case	

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STANDARD DEFINITIONS

Anritsu Network Analyzers

Table 8. Standard Definitions for Anritsu

Waveguide Parameters	
Cutoff Frequency	9.486 GHz
Offset Length Of Short 1	3.520 mm
Offset Length Of Short 2	10.55 mm

For specific loading instructions, see ***Anritsu loading instructions,*** which can be downloaded from our website: ***maurymw.com***.

Keysight Network Analyzers

Table 5. Standard Definitions for Keysight

Standard [1]		C0 $x10^{-15}$ F	C1 $x10^{-27}$ F/Hz	C2 $x10^{-36}$ F/Hz^2	C3 $x10^{-45}$ F/Hz^3	Fixed or Sliding [2]	Offset			Frequency GHz		Coax or W/G	Standard Label
Type	Description	L0 $x10^{-12}$ H	L1 $x10^{-24}$ H/Hz	L2 $x10^{-33}$ H/Hz^2	L3 $x10^{-42}$ H/Hz^3		Delay ps	Z_0 [3] Ω	Loss [4] GΩ/s	Min [5]	Max		
Short	P344A Fixed Short						0	1.0	0	9.486	999.0	W/G	P344A
Short	P340A1 1/8 Offset Short						11.741	1.0	0	9.486	999.0	W/G	P340A1
Short	P340A2 3/8 Offset Short						35.190	1.0	0	9.486	999.0	W/G	P340A2
Thru	Thru (0 cm)						0	1.0	0	9.486	999.0	W/G	Thru [5]
Load	P301A ( ) Fixed Load					Fixed	0	1.0	0	9.486	999.0	W/G	Fixed

[1] Open, short, load, delay/thru, or arbitrary impedance.
[2] Load or arbitrary impedance only.
[3] Z_0 normalized.
[4] Skin loss factor, normalized at 1 GHz.
[5] Test ports connected directly.

For specific loading instructions see ***Keysight loading instructions***, which can be downloaded from our website: ***maurymw.com***.

Rhode & Schwarz Network Analyzers

Table 9. Standard Definitions for Rohde & Schwarz

Short Label = P340A1 Min Freq = 9.486 GHz Max Freq = 18.0 GHz Length = 3.52 mm	Match Label = Fixed Min Freq = 9.486 GHz Max Freq = 18.0 GHz
Offset Short Label = P340A2 Min Freq = 9.486 GHz Max Freq = 18.0 GHz Length = 10.55 mm	Through Label = Thru (0 cm) Min Freq = 9.486 GHz Max Freq = 18.0 GHz Length = 0.0 mm

For specific loading instructions, see ***Rohde & Schwarz loading instructions***, which can be downloaded from our website: ***maurymw.com***.

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Table 1. Peak-to-Peak Ripple (dB) vs. Source Match vs. VSWR

P–P	SM	VSWR	P–P	SM	VSWR	P–P	SM	VSWR	P–P	SM	VSWR	P–P	SM	VSWR
0.001	84.8	1.000	0.051	50.7	1.006	0.102	44.7	1.012	0.205	38.6	1.024	0.455	31.8	1.053
0.002	78.8	1.000	0.052	50.5	1.006	0.104	44.5	1.012	0.210	38.4	1.024	0.460	31.7	1.054
0.003	75.3	1.000	0.053	50.3	1.006	0.106	44.3	1.012	0.215	38.2	1.025	0.465	31.6	1.054
0.004	72.8	1.000	0.054	50.2	1.006	0.108	44.2	1.012	0.220	38.0	1.025	0.470	31.5	1.055
0.005	70.8	1.001	0.055	50.0	1.006	0.110	44.0	1.013	0.225	37.8	1.026	0.475	31.4	1.055
0.006	69.2	1.001	0.056	49.8	1.006	0.112	43.8	1.013	0.230	37.6	1.027	0.480	31.3	1.056
0.007	67.9	1.001	0.057	49.7	1.007	0.114	43.7	1.013	0.235	37.4	1.027	0.485	31.2	1.057
0.008	66.7	1.001	0.058	49.5	1.007	0.116	43.5	1.013	0.240	37.3	1.028	0.490	31.1	1.057
0.009	65.7	1.001	0.059	49.4	1.007	0.118	43.4	1.014	0.245	37.1	1.028	0.495	31.0	1.058
0.010	64.8	1.001	0.060	49.2	1.007	0.120	43.2	1.014	0.250	36.9	1.029	0.500	30.9	1.058
0.011	64.0	1.001	0.061	49.1	1.007	0.122	43.1	1.014	0.255	36.7	1.030	0.505	30.9	1.059
0.012	63.2	1.001	0.062	49.0	1.007	0.124	43.0	1.014	0.260	36.6	1.030	0.510	30.8	1.060
0.013	62.5	1.001	0.063	48.8	1.007	0.126	42.8	1.015	0.265	36.4	1.031	0.515	30.7	1.060
0.014	61.9	1.002	0.064	48.7	1.007	0.128	42.7	1.015	0.270	36.2	1.031	0.520	30.6	1.061
0.015	61.3	1.002	0.065	48.6	1.007	0.130	42.6	1.015	0.275	36.1	1.032	0.525	30.5	1.061
0.016	60.7	1.002	0.066	48.4	1.008	0.132	42.4	1.015	0.280	35.9	1.032	0.530	30.4	1.062
0.017	60.2	1.002	0.067	48.3	1.008	0.134	42.3	1.015	0.285	35.8	1.033	0.535	30.4	1.063
0.018	59.7	1.002	0.068	48.2	1.008	0.136	42.2	1.016	0.290	35.6	1.034	0.540	30.3	1.063
0.019	59.2	1.002	0.069	48.0	1.008	0.138	42.0	1.016	0.295	35.5	1.034	0.545	30.2	1.064
0.020	58.8	1.002	0.070	47.9	1.008	0.140	41.9	1.016	0.300	35.3	1.035	0.550	30.1	1.064
0.021	58.4	1.002	0.071	47.8	1.008	0.142	41.8	1.016	0.305	35.2	1.035	0.555	30.0	1.065
0.022	58.0	1.003	0.720	47.7	1.008	0.144	41.7	1.017	0.310	35.0	1.036	0.560	30.0	1.066
0.023	57.6	1.003	0.073	47.5	1.008	0.146	41.5	1.017	0.315	34.9	1.037	0.565	29.9	1.066
0.024	57.2	1.003	0.074	47.4	1.009	0.148	41.4	1.017	0.320	34.8	1.037	0.570	29.8	1.067
0.025	56.8	1.003	0.075	47.3	1.009	0.150	41.3	1.017	0.325	34.6	1.038	0.575	29.7	1.067
0.026	56.5	1.003	0.076	47.2	1.009	0.152	41.2	1.018	0.330	34.5	1.038	0.580	29.7	1.068
0.027	56.2	1.003	0.077	47.1	1.009	0.154	41.1	1.018	0.335	34.4	1.039	0.585	29.6	1.068
0.028	55.9	1.003	0.078	47.0	1.009	0.156	41.0	1.018	0.340	34.3	1.040	0.590	29.5	1.069
0.029	55.6	1.003	0.079	46.9	1.009	0.158	40.9	1.018	0.345	34.1	1.040	0.595	29.5	1.070
0.030	55.3	1.003	0.080	46.8	1.009	0.160	40.8	1.019	0.350	34.0	1.041	0.600	29.4	1.070
0.031	55.0	1.004	0.081	46.6	1.009	0.162	40.6	1.019	0.355	33.9	1.041	0.605	29.3	1.071
0.032	54.7	1.004	0.082	46.5	1.009	0.164	40.5	1.019	0.360	33.8	1.042	0.610	29.2	1.071
0.033	54.4	1.004	0.083	46.4	1.010	0.166	40.4	1.019	0.365	33.6	1.042	0.615	29.2	1.072
0.034	54.2	1.004	0.084	46.3	1.010	0.168	40.3	1.019	0.370	33.5	1.043	0.620	29.1	1.073
0.035	53.9	1.004	0.085	46.2	1.010	0.170	40.2	1.020	0.375	33.4	1.044	0.625	29.0	1.073
0.036	53.7	1.004	0.086	46.1	1.010	0.172	40.1	1.020	0.380	33.3	1.044	0.630	29.0	1.074
0.037	53.4	1.004	0.087	46.0	1.010	0.174	40.0	1.020	0.385	33.2	1.045	0.635	28.9	1.074
0.038	53.2	1.004	0.088	45.9	1.010	0.176	39.9	1.020	0.390	33.1	1.045	0.640	28.8	1.075
0.039	53.0	1.004	0.089	45.8	1.010	0.178	39.8	1.021	0.395	33.0	1.046	0.645	28.8	1.076
0.040	52.8	1.005	0.090	45.7	1.010	0.180	39.7	1.021	0.400	32.9	1.047	0.650	28.7	1.076
0.041	52.6	1.005	0.091	45.6	1.011	0.182	39.6	1.021	0.405	32.7	1.047	0.655	28.6	1.077
0.042	52.3	1.005	0.092	45.5	1.011	0.184	39.5	1.021	0.410	32.6	1.048	0.660	28.6	1.077
0.043	52.1	1.005	0.093	45.5	1.011	0.186	39.5	1.022	0.415	32.5	1.048	0.665	28.5	1.078
0.044	51.9	1.005	0.094	45.4	1.011	0.188	39.4	1.022	0.420	32.4	1.049	0.670	28.4	1.079
0.045	51.7	1.005	0.095	45.3	1.011	0.190	39.3	1.022	0.425	32.3	1.050	0.675	28.4	1.079
0.046	51.6	1.005	0.096	45.2	1.011	0.192	39.2	1.022	0.430	32.2	1.050	0.680	28.3	1.080
0.047	51.4	1.005	0.097	45.1	1.011	0.194	39.1	1.022	0.435	32.1	1.051	0.685	28.3	1.080
0.048	51.2	1.006	0.098	45.0	1.011	0.196	39.0	1.023	0.440	32.0	1.051	0.690	28.2	1.081
0.049	51.0	1.006	0.099	44.9	1.011	0.198	38.9	1.023	0.445	31.9	1.052	0.695	28.1	1.082
0.050	50.8	1.006	0.100	44.8	1.012	0.200	38.8	1.023	0.450	31.8	1.052	0.700	28.1	1.082

APPENDIX

Data Sheet Resources

3H-001 – Waveguide Calibration Kits – Series Standard Kits
http://maurymw.com/pdf/datasheets/3H-081.pdf

5E-030 – Precision Waveguide Flanges – MPF22 & MPF19
http://maurymw.com/pdf/datasheets/5E-030.pdf

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