



This paper describes the procedure to perform a "TRL" calibration using Rohde & Schwarz ZVA series network analyzers with OML WR05 waveguide calibration kit. OML WR05 waveguide calibration kit standard definitions were previously transformed to a calkit file recognized by ZVA series network analyzers using ZVA built-in WR05 waveguide calkits. The 4-Port ZVA24 network analyzer used to develop this procedure has the following installed options with firmware version 4.01.

Software Option - ZVA-K8 Converter Control

Hardware Option

- ZVAB-B4	- ZVA24-B22
- ZVA24-B32	- ZVA24-B23
- ZVA24-B34	- ZVA24-B24
- ZVA24-B16	- ZVA24-B31
- ZVA24-B21	- ZVA24-B33

This paper assumes the ZVA series network analyzer has been configured to work with OML millimeter wave frequency extension modules and recognizes OML waveguide calibration kit standard definitions.

Application note "Configure Rohde & Schwarz ZVA Series Network Analyzers for OML Millimeter Wave Frequency Extension Modules" provides an in depth review of configuring ZVA series network analyzers to work with OML frequency extension modules. Application note "Converting OML Waveguide Calibration Kit Standard Definitions to function in Rohde & Schwarz ZVA Series Network Analyzers" discusses transformation of OML calkit standard definitions to operate in ZVA series network analyzers.

## **Instrumentation Configuration**

ZVA with firmware version 4.01 is used for capturing the screen displays in this procedure. Different firmware versions may have slightly different displays.

The steps below show the procedure to create OML WR05 waveguide calibration kits. This same procedure applies for all other waveguide band calibration kits.

## **Start TRL Calibration**

 Click "Channel" pull down menu with mouse. Highlight or click "Calibration", follow by "Two-Port P1P2" and then click "TRL" sidemenu (Figure 1).



**Figure 1 – Calibration Startup Configuration** 

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Select Port 1 and Port 2 Connector Type to be "WR05" and Calibration Kit V05-AL-30 to Port 1 and Port 2 using the pull down arrow once <u>Calibration</u> table appears (Figure 2).

File Trace Channel Display System Window Info Help	_ B ×
Calibration	×
Select Physical VNA Test Port Connector(s)	\$
2     Same Connector Type at All Ports       * Connector     Char Imp       Port 1     WR05       Yaries     V05-AL-30       Yaries     V05-AL-30       Yaries     V05-AL-30       Yaries     V05-AL-30       Yaries     V05-AL-30	
Same Sweep Setup for All Standards When connecting waveguide flanges, please take care of field orientation	
< <u>Back</u> Next> Cancel	Help
Trc1 S11 dB Mag 20 dB / Ref 0 dB Ch1 Cal	LOCAL

Figure 2 – Calibration Dialogue Table

- 3. Click **Next** to start standards measurement.
- 4. Connect waveguide CalKit **Short** to Port 1 and select "**Port 1: WR05**" to start Port 1 "**Reflect**" standard measurement. A "green" check mark will appear once measurement is completed (Figure 3).
- 5. Remove waveguide short from Port1 and connect it to Port 2.

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	Info Help
Calibration	
	<b>X</b>
Measured Standards (0 of 4):           Port 1         WR05           Beflect 115.696 GHz 231.3982 GHz REFI           C         Port 2           WR05         Reflect 115.696 GHz 231.3982 GHz REFI           C         Port 1: WR05 - Port 2: WR05           Through 115.696 GHz 231.392 GHz THR           Line 1         115.696 GHz 231.392 GHz OFFS	
	Ch1 140 GHz 220 GHz
Show Measurement Diagram	
✓ Keep Measurement Data for >Repeat Previous Cal<	Abort Sweep
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	Career Trep
Trc1 S11 dB Mag 20 dB / Ref 0 dB Ch1 Cal	Info Help
Calibration	
Measure Standards	
Measured Standards (1 of 4):         Port 1       WR05         ✓       Reflect 115.696 GHz 231.3982 GHz REFI         ✓       Port 2         WR05       Reflect 115.696 GHz 231.3982 GHz REFI         ✓       Port 1: WR05 - Port 2: WR05         ☐       Through 115.696 GHz 231.392 GHz THR         ☐       Line 1         115.696 GHz 231.392 GHz OFFS	Reflect 115.696 GHz 231.3982 GHz REFLECT in V05-         \$11 dB Mag 10 dB ()       \$11 Phase 45* ()         10       10       10         10       10       10       10         10       10       10       10       10         10       10       10       10       10       10         10       10       10       10       10       10       10         10
Show Measurement Diagram	
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6. Select "**Port 2: WR05**" to start Port 2 "**Reflect**" standard measurement. A "green" check mark will appear once measurement is completed (Figure 4).

🥅 File Trace Channel Display System Window	v Info Help	_ & ×
Calibration		X
Measure Standards		
Measured Standards (2 of 4): Port 1: WR05 Reflect 115.696 GHz 231.3982 GHz REFI Reflect 115.696 GHz 231.3982 GHz REFI Cov Port 1: WR05 - Port 2: WR05 Intrough 115.696 GHz 231.392 GHz THR Line 1 115.696 GHz 231.392 GHz OFFS	Reflect 115.696 GHz 231.3982 GHz REFLECT in V05 S22 dB Mag 10 dB / S22 Phase 45" / 10 10 10 10 10 10 10 10 10 10	
	Ch1 140 GHz 220 GHz	
<ul> <li>Show Measurement Diagram</li> <li>Show Phase</li> <li>Keep Measurement Data for &gt;Repeat Previous Cal</li> </ul>	Abort Sweep	
	<back apply="" cancel<="" td=""><td>Help</td></back>	Help
Trc1 S11 dB Mag 20 dB / Ref0 dB Ch1 Cal	Ch2:	

Figure 4 – Port 2 "Reflect" Standard Measurement

- 7. Remove waveguide short from Port 2 and connect Port 1 to Port 2 directly.
- 8. Select "**Port 1: WR05 Port 2: WR05 -Through**" to start "**Thru**" standard measurement. A "green" check mark will appear once measurement is completed (Figure 5).

💻 File Trace Channel Display System Window Info Help	_ & ×
Calibration	×
Measure Standards	
Measured Standards (3 of 4):       Through 115.696 GHz 231.392 GHz THRU in V05-AL-         Port 1       WR05         Port 2       WR05         Port 2       WR05         Port 1       WR05 - Port 2: WR05         Port 1       115.696 GHz 231.392 GHz         Port 1       115.696 GHz 231.392 GHz         OF       115.696 GHz 231.392 GHz	
✓ Chi 140 GHz 220 GHZ ✓ Show Measurement Diagram ✓ Show Phase	
Keep Measurement Data for >Repeat Previous Cal< Abort Sweep	
< <u>B</u> ack Apply Cancel	Help
Trc1 S11 dB Mag 20 dB / Ref 0 dB Ch1 Cal	LOCAL

Figure 5 – "Thru" Standard Measurement



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- 9. Disengage Port 1 from Port 2 and insert the 1/4 waveguide shim (1/4OS-05) between Port 1 and Port 2.
- 10.Select "**Port 1: WR05 Port 2: WR05- Line 1**" to start "**Line**" standard measurement. A "green" check mark will appear once measurement is completed (Figure 5).

💻 File Trace Channel Display System Window	v Info Help	_ B ×
Calibration		X
Measure Standards		
Measured Standards (4 of 4): Port 1; WR05 Reflect 115.696 GHz 231.3982 GHz REFI Reflect 115.696 GHz 231.3982 GHz REFI Port 1; WR05 - Port 2; WR05 Port 1; WR05 - Port 2; WR05 Inrough 115.696 GHz 231.392 GHz THR Inre 1 115.696 GHz 231.392 GHz OFFS	Line 1 115.696 GHz 231.392 GHz OFFSET LINE in VC S21 dB Mag 10 dB / S21 Phase 45" / 10 10 10 10 10 10 10 10 10 10	
	Ch1 140 GHz 220 GHz	
<ul> <li>Show Measurement Diagram</li> <li>Show Phase</li> </ul>		
Keep Measurement Data for >Repeat Previous Cal<	Abort Sweep	
	< <u>Back</u> Apply Cancel	Help
Trc1 S11 dB Mag 20 dB / Ref0 dB Ch1 Cal	★ Ch2: 💷	

Figure 6 – "Line" Standard Measurement

11. Click **Apply** to use the TRL calibration to subsequent two-port measurements.

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