

**Calibration Guide**

# **Model OSL Series**

**Precision Open/Short/Load Calibration Tees**





## **WARRANTY**

The Anritsu product(s) listed on the title page is (are) warranted against defects in materials and workmanship for one year from the date of shipment. Anritsu's obligation covers repairing or replacing products which prove to be defective during the warranty period. Buyers shall prepay transportation charges for equipment returned to Anritsu for warranty repairs. Obligation is limited to the original purchaser. Anritsu is not liable for consequential damages.

## **LIMITATION OF WARRANTY**

The foregoing warranty does not apply to Anritsu connectors that have failed due to normal wear. Also, the warranty does not apply to defects resulting from improper or inadequate maintenance by the Buyer, unauthorized modification or misuse, or operation outside of the environmental specifications of the product. No other warranty is expressed or implied, and the remedies provided herein are the Buyer's sole and exclusive remedies.

## **DISCLAIMER OF WARRANTY**

DISCLAIMER OF WARRANTIES. TO THE MAXIMUM EXTENT PERMITTED BY APPLICABLE LAW, ANRITSU COMPANY AND ITS SUPPLIERS DISCLAIM ALL WARRANTIES, EITHER EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, WITH REGARD TO THE SOFTWARE PRODUCT. THE USER ASSUMES THE ENTIRE RISK OF USING THE PROGRAM. ANY LIABILITY OF PROVIDER OR MANUFACTURER WILL BE LIMITED EXCLUSIVELY TO PRODUCT REPLACEMENT.

NO LIABILITY FOR CONSEQUENTIAL DAMAGES. TO THE MAXIMUM EXTENT PERMITTED BY APPLICABLE LAW, IN NO EVENT SHALL ANRITSU COMPANY OR ITS SUPPLIERS BE LIABLE FOR ANY SPECIAL, INCIDENTAL, INDIRECT, OR CONSEQUENTIAL DAMAGES WHATSOEVER (INCLUDING, WITHOUT LIMITATION, DAMAGES FOR LOSS OF BUSINESS PROFITS, BUSINESS INTERRUPTION, LOSS OF BUSINESS INFORMATION, OR ANY OTHER PECUNIARY LOSS) ARISING OUT OF THE USE OF OR INABILITY TO USE THE SOFTWARE PRODUCTS, EVEN IF ANRITSU COMPANY HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES. BECAUSE SOME STATES AND JURISDICTIONS DO NOT ALLOW THE EXCLUSION OR LIMITATION OF LIABILITY FOR CONSEQUENTIAL OR INCIDENTAL DAMAGES, THE ABOVE LIMITATION MAY NOT APPLY TO YOU.

## **NOTICE**

Anritsu Company has prepared this manual for use by Anritsu Company personnel and customers as a guide for the proper installation, operation and maintenance of Anritsu Company equipment and computer programs. The drawings, specifications, and information contained herein are the property of Anritsu Company, and any unauthorized use or disclosure of these drawings, specifications, and information is prohibited; they shall not be reproduced, copied, or used in whole or in part as the basis for manufacture or sale of the equipment or software programs without the prior written consent of Anritsu Company.

## **UPDATES**

Updates, if any, can be downloaded from the Documents area of the Anritsu web site at: <http://www.anritsu.com>

For the latest service and sales information in your area, please visit: <http://www.anritsu.com/contact.asp>

## Notes On Export Management

This product and its manuals may require an Export License or approval by the government of the product country of origin for re-export from your country.

Before you export this product or any of its manuals, please contact Anritsu Company to confirm whether or not these items are export-controlled.

When disposing of export-controlled items, the products and manuals need to be broken or shredded to such a degree that they cannot be unlawfully used for military purposes.

### European Parliament and Council Directive 2002/96/EC



## Chinese RoHS Compliance Statement

产品中有毒有害物质或元素的名称及含量

For Chinese Customers Only NLNB

部件名称	有毒有害物质或元素					
	铅 (Pb)	汞 (Hg)	镉 (Cd)	六价铬 [Cr(VI)]	多溴联苯 (PBB)	多溴二苯醚 (PBDE)
印刷线路板 (PCA)	×	○	×	×	○	○
机壳、支架 (Chassis)	×	○	×	×	○	○
其他(电缆、风扇、 连接器等) (Appended goods)	×	○	×	×	○	○
○：表示该有毒有害物质在该部件所有均质材料中的含量均在 SJ/T11363-2006 标准规定的限量要求以下。						
×：表示该有毒有害物质至少在该部件的某一均质材料中的含量超出 SJ/T11363-2006 标准规定的限量要求。						

环保使用期限



这个标记是根据 2006/2/28 公布的「电子信息产品污染控制管理办法」以及 SJ/T 11364-2006 「电子信息产品污染控制标识要求」的规定，适用于在中国销售的电子信息产品的环保使用期限，仅限于在遵守该产品的安全规范及使用注意事项的基础上，从生产日起算的该年限内，不会因产品所含有害物质的泄漏或突发性变异，而对环境污染，人身及财产产生深刻地影响。

注) 生产日期标于产品序号的前四码(如 S/N 0728XXXX 为 07 年第 28 周生产)。

---

## Safety Symbols

---

To prevent the risk of personal injury or loss related to equipment malfunction, Anritsu Company uses the following symbols to indicate safety-related information. For your own safety, please read the information carefully *before* operating the equipment.

### Symbols Used in Manuals

#### Danger



This indicates a risk from a very dangerous condition or procedure that could result in serious injury or death and possible loss related to equipment malfunction. Follow all precautions and procedures to minimize this risk.

#### Warning



This indicates a risk from a hazardous condition or procedure that could result in light-to-severe injury or loss related to equipment malfunction. Follow all precautions and procedures to minimize this risk.

#### Caution



This indicates a risk from a hazardous procedure that could result in loss related to equipment malfunction. Follow all precautions and procedures to minimize this risk.

## — Safety Symbols Used on Equipment and in Manuals —

The following safety symbols are used inside or on the equipment near operation locations to provide information about safety items and operation precautions. Ensure that you clearly understand the meanings of the symbols and take the necessary precautions *before* operating the equipment. Some or all of the following five symbols may or may not be used on all Anritsu equipment. In addition, there may be other labels attached to products that are not shown in the diagrams in this manual.



This indicates a prohibited operation. The prohibited operation is indicated symbolically in or near the barred circle.



This indicates a compulsory safety precaution. The required operation is indicated symbolically in or near the circle.



This indicates a warning or caution. The contents are indicated symbolically in or near the triangle.



This indicates a note. The contents are described in the box.



These indicate that the marked part should be recycled.

# Table of Contents

---

## Chapter 1—General Information

1-1	Introduction . . . . .	1-1
1-2	Description . . . . .	1-1
1-3	Recommended Test Equipment . . . . .	1-2

## Chapter 2—OSL Performance Verification

2-1	Introduction . . . . .	2-1
2-2	Required Equipment . . . . .	2-1
2-3	Specifications . . . . .	2-2
2-4	Verification Using MS4642A . . . . .	2-3
	Model MS4642A Calibration . . . . .	2-3
	OSL Load Return Loss Verification . . . . .	2-5
	OSL Open/Short 180° Phase Shift Verification . . . . .	2-6
2-5	Verification Using 37247x/ 37347x . . . . .	2-8
	VNA Model 37247x, 37347x Calibration . . . . .	2-8
	OSL Load Return Loss Verification . . . . .	2-9
	OSL Open/Short 180° Phase Shift Verification . . . . .	2-10
2-6	Load DC Resistance Verification . . . . .	2-11

## Table of Contents (Continued)

---

# Chapter 1 — General Information

## 1-1 Introduction

This guide provides performance verification procedures for Anritsu Model OSL Series Open/Short/Load Calibration Tees.

## 1-2 Description

The model OSL Series family consists of the following models:

**Table 1-1.** OSL Series Precision Open/Short/Load Calibration Tees

<b>Anritsu Part Number</b>	<b>Description</b>
OSLN50LF	N male Precision Open/Short/Load, DC to 4 GHz
OSLNF50LF	N female Precision Open/Short/Load, DC to 4 GHz
OSLN50-1	N male Precision Open/Short/Load, DC to 6 GHz
OSLNF50-1	N female Precision Open/Short/Load, DC to 6 GHz
OSLN50	N male Precision Open/Short/Load, DC to 18 GHz
OSLNF50	N female Precision Open/Short/Load, DC to 18 GHz
OSLK50	K male Precision Open/Short/Load, DC to 20 GHz
OSLKF50	K female Precision Open/Short/Load, DC to 20 GHz

## 1-3 Recommended Test Equipment

**Table 1-2.** Recommended Test Equipment

<b>Equipment</b>	<b>Critical Specification</b>	<b>Recommended Manufacturer/Model</b>
Vector Network Analyzer	Frequency: 40 MHz to 20 GHz	Anritsu Model MS4642A, 37247D or 37347D
Calibration Kit	Connector Type: N Impedance: 50 $\Omega$ Termination: sliding termination	Anritsu Model SC8148
Adapter	Connector: N(m) to K(f)	Anritsu Model 34NKF50
Adapter	Connector: N(f) to K(f)	Anritsu Model 34NFKF50
Digital Multi-meter		Agilent Model 34401A
Calibration Kit	Connector Type: N Impedance: 50 $\Omega$ Termination: Sliding Termination	Anritsu Model 3652A-1
Adapter	Connector: K(f) to K(f)	Anritsu Model 33KFKF50
Adapter	Connector: K(m) to K(f)	Anritsu Model 33KKF50

# Chapter 2 — OSL Performance Verification

## 2-1 Introduction

This chapter provides tests to verify the performance of the OSL Series Open/Short/Load Calibration Tees. Two separate verification procedures are provided, for using either a VectorStar MS4642A, a Model 37247x, or a Model 37347x VNA:

- [Section 2-4 “Verification Using MS4642A”](#)
- [Section 2-5 “Verification Using 37247x/ 37347x”](#)

Verification tests include:

- **Return Loss Verification**  
The Load is verified by measuring the return loss using a VNA.
- **Open and Short 180° Phase Shift Verification**  
The Open and Short 180° phase shift is verified by measuring the phase using a VNA.
- **Load DC Resistance Verification**

## 2-2 Required Equipment

- Anritsu Model MS4642A, 37247D or 37347D Vector Network Analyzer
- Anritsu Model SC8148 N Connector Calibration Kit or 3652A-1 K Connector Calibration Kit
- Anritsu Model 33KFKF50, 33KKF50, 34NKF50, or 34NFKF50 Adapter

## 2-3 Specifications

Refer to [Table 2-1](#) for the OSL series specifications.

**Table 2-1.** OSL Series Specifications

Specification	Anritsu Part Number			
	OSLK50LF OSLKF50LF	OSLN50LF OSLNF50LF	OSLN50-1 OSLNF50-1	OSLN50 OSLNF50
Frequency Range	DC to 20 GHz	DC to 4 GHz	DC to 6 GHz	DC to 18 GHz
Load DC Resistance	50 $\Omega \pm 0.20 \Omega$	50 $\Omega \pm 0.25 \Omega$	50 $\Omega \pm 0.25 \Omega$	50 $\Omega \pm 0.15 \Omega$
Return Loss	42 dB: DC to 5 GHz 36 dB: 5 to 15 GHz 32 dB: 15 to 20 GHz	42 dB	42 dB	42 dB: DC to 5 GHz 36 dB: 5 to 15 GHz 32 dB: 15 to 18 GHz
Open and Short Phase Shift	180° $\pm$ 6°	180° $\pm$ 6°	180° $\pm$ 10°	180° $\pm$ 20°

**Caution**

To avoid connector damage or inaccurate measurements, before making any connections, inspect mating surfaces for damage, clean the connectors, and use proper torquing practices. Review *10100-00031, RF and Microwave Connector Care*.

**Table 2-2.** Connector Torque Specifications

Connector Type/Size	Wrench Size	Torque Setting
K (2.92 mm)	8 mm (5/16 in)	0.9 N·m (8 lbf·in)
Type N (With Flats)	19 mm (3/4 in)	1.35 N·m (12 lbf·in)

---

## 2-4 Verification Using MS4642A

### Model MS4642A Calibration

#### Preliminary

1. Allow the VNA to warm up for a minimum of 1 hour.
2. Install an appropriate adapter to the VNA Port 1 so the test port has a connector that can mate to the OSL Series Open/Short/Load Calibration Tee.

For example, install a 34NFKF50 adapter to VNA Port 1 when testing an N-male Open/Short/Load Calibration Tee.

3. Press the **Preset** key to reset the VNA.

#### Set Frequency Range

1. Press the **Frequency** key then set the frequency as follows:
  - a. START: 40 MHz
  - b. STOP:
    - 4 GHz for OSLN50LF or OSLNF50LF
    - 6 GHz for OSLN50-1 or OSLNF50-1
    - 18 GHz for OSLN50 or OSLNF50
    - 20 GHz for OSLK50 or OSLKF50
  - c. POINTS: 401

#### Load Cal Kit Coefficients

To load the Cal Kit Coefficients into the VNA:

1. Insert Calibration Component Coefficients USB Memory Stick of the appropriate calibration kit into the VNA USB port.
2. Press the Calibration key then:
  - a. Select Cal kit/Autocal/Characterization | Install Kit/Charac | Cal Kit radio button
  - b. Browse for and select USB Memory Stick.
  - c. Select the Cal Kit file then select Open | OK | Install

**Calibrate the Vector Star VNA**

1. Press the Calibration key then:

- a. Select Calibrate | Manual Cal | 1-Port Cal | Modify Cal Setup | Cal Method: SOLT/SOLR | Line Type: Coaxial

2. Edit Cal Params:

- a. Test Port 1 selected.

- b. DUT Connector:

Select one of the following from the drop-down:

- N-Conn(m) for OSLN50LF, OSLN50-1 or OSLN50
- N-Conn(f) for OSLNF50LF, OSLNF50-1 or OSLNF50
- K-Conn(m) for OSLK50
- K-Conn(f) for OSLKF50

- c. BB Load: Select Load 1.

- d. Load Type: Select Sliding Load.

- e. Test Port 2: Unselected

- f. Select OK.

3. Select Back.

4. Select Port 1 Reflective Devices.

- a. Connect each calibration standard (Open, Short or Load) before selecting the matching box.

- b. Connect the sliding load and then select Sliding Load.

- c. Set the sliding load to the number 1 position before selecting the Position 1 box.

Repeat for positions number 2 through number 6.

5. Select Back | Back | Done

---

## OSL Load Return Loss Verification

1. Connect the LOAD of the DUT Calibration Tee to the adapter on VNA Port 1.
2. Set the VNA as follows:
  - a. Double click on the Tr1/ S11 title so the Trace 1 plot will be displayed full screen.
  - b. Select Display | Trace Format | Log Mag
  - c. Select Scale | Auto Scale Active Trace
  - d. Select Marker | Mkr1 on
  - e. Select Marker Search | Max
  - f. The MARKER 1 will display the highest point (worst case in return loss) in frequency and a negative number in dB (for example, -43.123 dB at 3 GHz).
  - g. Record the absolute value of MARKER 1 as return loss (for example, 43.123 dB).
  - h. The Return Loss spec is 42 dB. The worst case absolute value of Marker 1 Readout in dB must be > 42 dB to pass this test.
  - i. For OSLK, OSLKF, OSLN50 and OSLNF50, the return loss is specified for three frequency bands. Manually drag Marker 1 with the mouse to read out the worst case return loss in each band.

## OSL Open/Short 180° Phase Shift Verification

1. Set the VNA as follows:

- a. Double click on the Tr1/ S11 title so the Trace 1 plot will be displayed full screen.
- b. Select Display | Trace Format | Phase
- c. Scale setup:
  - Select Scale
  - Select Resolution | enter 10°/div
  - Select Reference value | enter 180°
  - Select Reference Position | enter 5
  - Select Wrap Setup | Wrapping OFF
- d. Trace Limit Lines setup:

Phase limits are entered into a table displayed on the VNA screen as shown in the example [Table 2-3 on page 2-7](#):

- Select Display | Trace Limit Lines
- Select Limit Line | ON
- Select Edit Limit Line
- Select Add (Fill in upper limit row in table)
- Select Add (Fill in lower limit row in table)

Enter the phase limits for the applicable OSL model into the table:

- OSLN50LF and OSLNF50LF:  
Upper 174°, lower 186°; for
- OSLN50LF-1 and OSLNF50LF-1:  
Upper 170°, lower 190°
- OSLN50 and OSLNF50:  
Upper 160°, lower 200°
- OSLK50 and OSLKF50:  
Upper 168°, lower 192°

**Table 2-3.** Example of Table with OSLK50 Limits

Type	X1	X2	Y1	Y2	X Offset	Y Offset
<b>Upper</b>	40 MHz	20 GHz	168°	168°		
<b>Lower</b>	40 MHz	20 GHz	192°	192°		

2. Connect the SHORT of the DUT Calibration Tee to the adapter on VNA Port 1.
3. Make the following selections on the VNA:  
 Select Display | View Trace | Store Data to Memory | Data Memory Math | Data Mem. Op. | Select Data/Mem. from the dropdown.
4. Remove the SHORT and connect the OPEN of the same DUT Calibration Tee to the adapter on VNA Port 1.
5. The displayed trace must be within the limit lines to pass the specification. The actual value can be verified using markers.

## 2-5 Verification Using 37247x/ 37347x

### VNA Model 37247x, 37347x Calibration

1. Allow the VNA to warm up for a minimum of 1 hour.
2. Install an appropriate adapter to the VNA Port 1 so the test port has a connector that can mate to the OSL Series Open/Short/Load Calibration Tee. For example, install a 34NFKF50 adapter to VNA Port 1 when testing an N-male Open/Short/Load Calibration Tee.
3. Insert the Calibration Component Coefficients USB memory stick from the appropriate calibration kit into the VNA USB port (if available), or insert the Calibration Component Coefficients disk into the VNA floppy drive.
4. Load the Cal Kit Coefficients into the VNA:
  - a. Press the **Utility Menu** key
  - b. Cal Component Utilities
  - c. Install the information from the USB memory stick or from the floppy disk.
5. Press the **Default Program** key to reset the VNA.
6. Press the **BeginCal** key then set the calibration as follows:
  - a. CAL METHOD: SOLT
  - b. TRANSMISSION LINE TYPE: COAXIAL
  - c. CALIBRATION TYPE: REFLECTION ONLY
  - d. PORT 1 ONLY (S11)
  - e. CALIBRATION DATA POINTS: NORMAL (1601 points maximum)
  - f. START frequency: 40 MHz
  - g. STOP frequency:
    - 4 GHz for OSLN50LF or OSLNF50LF
    - 6 GHz for OSLN50-1 or OSLNF50-1
    - 18 GHz for OSLN50 or OSLNF50
    - 20 GHz for OSLK50 and OSLKF50
  - h. MAXIMUM NUMBER OF DATA POINTS: 401

**i. PORT 1 CONN:**

N(f) for OSLN50LF, OSLN50-1 or OSLN50

N(m) for OSLNF50LF, OSLNF50-1 or OSLNF50

K(f) for OSLK50

K(m) for OLSKF50

**j. LOAD TYPE: SLIDING**

7. Select START CAL and follow the on screen prompt and connect the appropriate calibration standard(s) to complete the calibration.

## **OSL Load Return Loss Verification**

1. Connect the LOAD of the DUT Calibration Tee to the adapter on VNA Port 1.
2. Set the VNA as follows:
  - a. Channel Menu: SINGLE CHANNEL
  - b. CH1
  - c. S-parameter: S11
  - d. GRAPH TYPE: LOG MAGNITUDE
  - e. Auto Scale
  - f. Marker Menu: MARKER 1 ON, DISPLAY MARKERS ON
  - g. Readout Marker: MARKER TO MAX
  - h. The MARKER 1 will display the highest point (worst case in return loss) in frequency and a negative number in dB (for example, -43.123 dB at 3 GHz).
  - i. Record the absolute value of MARKER 1 as return loss (for example, 43.123 dB).
  - j. The Return Loss spec is 42 dB. The worst case absolute value of Marker 1 Readout in dB must be > 42 dB to pass this test.
  - k. For OSLK50, OLSKF50, OSLN50, and OSLNF50, the return loss is specified for three frequency bands. The rotary knob should be used to move the Marker 1 to read out the worst case return loss in each band.

## **OSL Open/Short 180° Phase Shift Verification**

- 1. Set the VNA as follows:**
  - a. Channel Menu: Single channel**
  - b. Ch 1**
  - c. S-parameter: S11**
  - d. Graph type: Phase**
  - e. Set Scale: resolution 10°/div, reference value 180°;  
phase shift 10°**
  - f. Limits:**
    - upper 174°, lower 186°; for OSLN50LF and OSLNF50LF
    - upper 170°, lower 190°; for OSLN50-1 and OSLNF50-1
    - upper 160°, lower 200°; for OSLN50 or OSLNF50
    - upper 168°, lower 192°; for OSLK50 OR OSLKF50
    - display limits ON
- 2. Connect the SHORT of the DUT Calibration Tee to the adapter on VNA Port 1.**
- 3. Make following selection on the VNA:**
  - a. Ch 1**
  - b. Trace Memory**
  - c. VIEW DATA**
  - d. STORE DATA TO MEMORY**
  - e. VIEW DATA (/) BY MEMORY**
- 4. Remove the SHORT and connect the OPEN of the same DUT Calibration Tee to the adapter on VNA Port 1.**
- 5. The displayed trace must be within the limit lines to pass the specification. The actual value can be verified using markers.**

## 2-6 Load DC Resistance Verification

### Equipment Required

- Agilent Model 34401A Multi-meter

### Procedure

Use an Ohmmeter to measure the DC resistance between the outer conductor and center conductor of the Load and verify that it is within specification (refer to [Table 2-1, “OSL Series Specifications”](#)).

## **2-6 Load DC Resistance Verification OSL Performance Verification**



# Anritsu



10100-00055



C



Anritsu prints on recycled paper with vegetable soybean oil ink.

Anritsu Company  
490 Jarvis Drive  
Morgan Hill, CA 95037-2809  
USA

<http://www.anritsu.com>