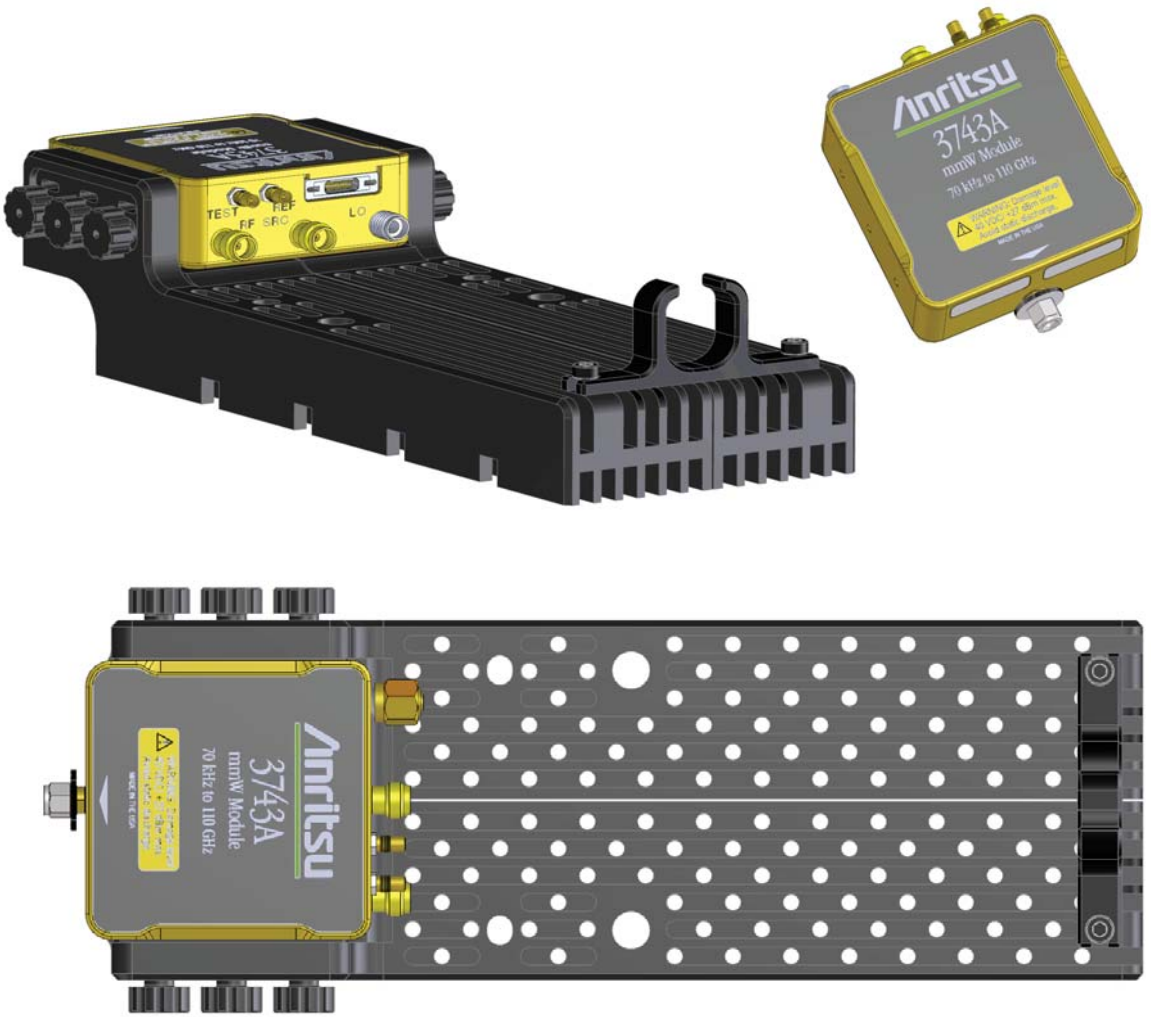
**Reference Manual**

# 3743A Millimeter-Wave Module

## VectorStar ME7838A Broadband/Millimeter-Wave VNA System and 3739A Test Set

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# Table of Contents

# Chapter 1 — 3743A Millimeter-Wave Module

## 1-1 Introduction

This manual provides description and maintenance instructions for the 3743A Millimeter-Wave (mm-Wave or as labeled, mmW) Module. The 3743A Module is used with the VectorStar ME7838A Broadband/Millimeter-Wave (BB/mm-Wave) VNA System and the 3739A Broadband Test Set. When the ME7838A system is ordered, the typical configuration provides a 3739A Broadband Test Set and two 3743A Modules to be used with the VNA. Each module is characterized for a specific VNA Serial Number and a specific VNA Test Port. Additional information for heat sinking and providing a user-defined mounting bracket is also provided. Complete installation documentation is in the **VectorStar ME7838A Broadband/Millimeter-Wave VNA System Installation Guide – 10410-00293**.

## 1-2 3743A Millimeter-Wave Module and Bracket

This chapter provides illustrations of the 3743A Module and its mounting bracket. The 3743A Module shipping container provides the following components for one (1) module:

- 3743A Module, mounted in bracket assembly below.
- Bracket Assembly
- Knurled Thumbscrews, M2 x 8 mm, six (6) each, holding the module into the bracket.

The figure below shows the module-to-bracket orientation in the as shipped configuration.

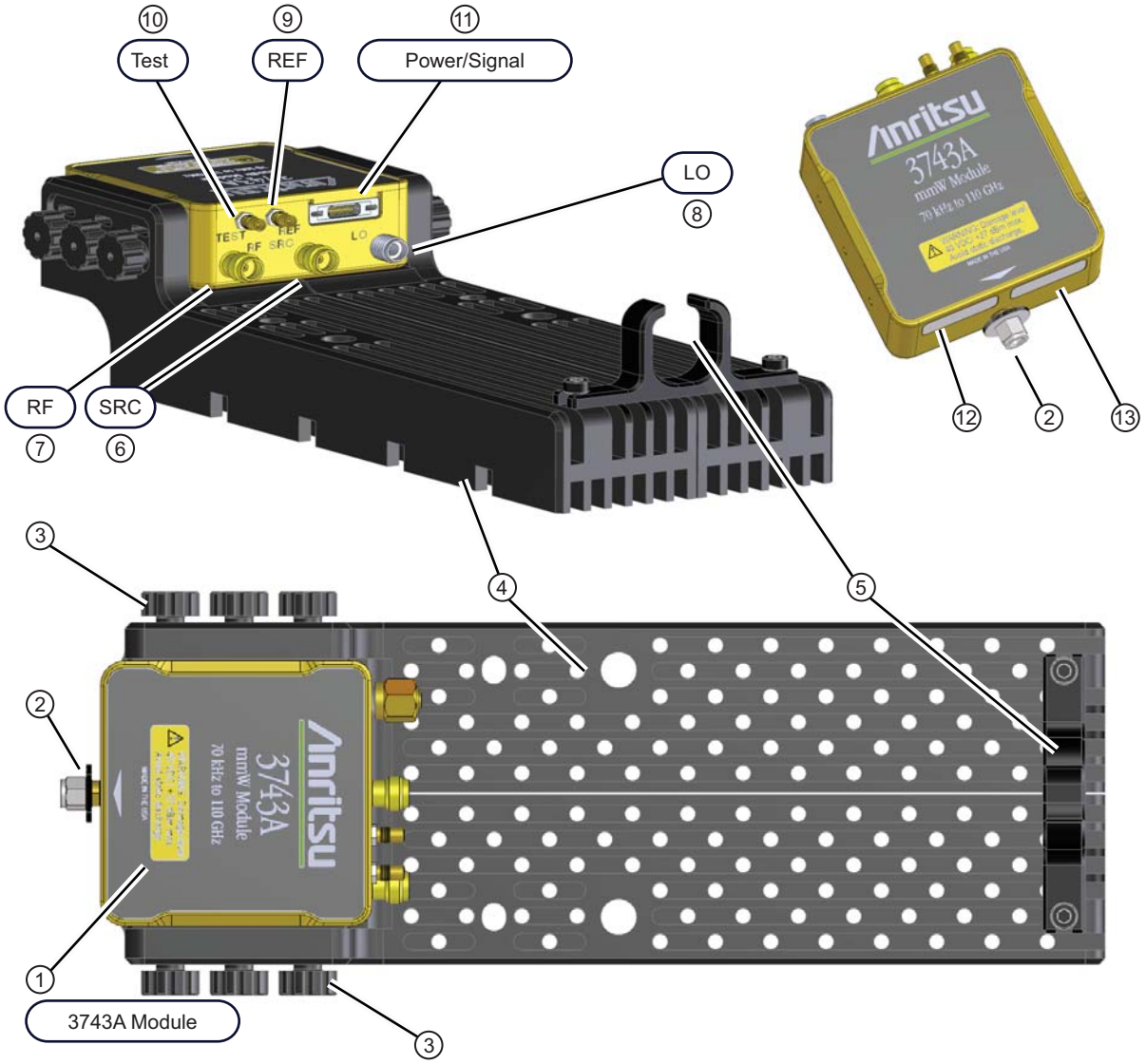



**Figure 1-1.** 3743A Millimeter-Wave Module – In Bracket – As-Shipped Configuration (1 of 2)

| | |
|---|---|
| 1 – 3743A Millimeter-Wave Module in Bracket as-shipped.<br><br>2 – **W1** Connector<br>• To tighten, use a torque end wrench and a plain end wrench.<br>• 6 mm Torque End Wrench set to 0.45 N·m (4 lbf·in). Recommended is Anritsu 01-504.<br>• 6 mm / 7 mm Open End Wrench. Recommended is Anritsu 01-505.<br><br>3 – Knurled M2 × 8 mm Mounting Screws<br>• 3 per side, 6 per module, 12 per systems<br>• Screws slide through bracket clearance holes into threaded module holes.<br>• Tighten finger tight. Do not over torque.<br>• If the module is installed in a user-provided bracket, use hand tightening, making sure that between 5 mm and 6 mm of screw threads are engaged in the module body.<br>• Note that the module mounting holes are 8.6 mm deep.<br>• Do not bottom out screws.<br>• Do not over torque. | 4 – Module Mounting Bracket<br><br>5 – Module Power/Signal Cable Restraint<br><br>6 – **SRC** V connector<br>• To tighten, use an 8 mm (5/16”) torque end wrench set to 0.9 N·m (8 lbf·in).<br>• Recommended is Anritsu 01-201.<br><br>7 – **RF** V connector – Torque as above.<br><br>8 – **LO** K connector – Torque as above.<br><br>9 – **REF** SSMC connector<br>• To tighten, use a 4 mm (5/32”) torque end wrench set to less than 0.22 N·m (2 lbf·in).<br>• Recommended is Anritsu 01-511 torque wrench.<br><br>10 – **TEST** SSMC connector – Torque as above.<br><br>11 – **Power/Signal** Snap Micro-D connector<br>• Be sure of cable plug orientation and keying before connections.<br><br>12 – Factory Calibrated Port Assignment Label<br><br>13 – Module Serial Number Label |

**Figure 1-1.** 3743A Millimeter-Wave Module – In Bracket – As-Shipped Configuration (2 of 2)

If required, the module can be turned over for different W1 connector access as shown below in Figure 1-2.


| | |
|---|---|
| 1 – The 3743A Module can be placed in an alternate position by removing the Knurled Thumbscrews and turning the module upside down.<br>• In this orientation, the **W1** connector is farthest from the bottom of the bracket.<br>• The **W1** connector is opposite the **SRC** connector. | 2 – Connect the bottom row of connectors first, from middle to right side, and then left side, using torque factors described above:<br>• **REF**<br>• **TEST**<br>• **Power/Signal**<br><br>3 – Connect the top row of connectors last, from middle to right side, then left side, using torque factors described above:<br>• **SRC**<br>• **RF**<br>• **LO** |

**Figure 1-2.** 3743A Millimeter-Wave Module – In Bracket – Alternate Module Orientation

# 1-3 Available Documentation

## ME7838A Documents

The following documentation is available for the VectorStar ME7838A Broadband/Millimeter-Wave VNA System:

- ME7838A Series Modular Broadband/Millimeter-Wave Technical Data Sheet – 11410-00593
- ME7838A Series Modular Broadband/Millimeter-Wave Quick Start Guide – 10410-00292
- ME7838A Series Modular Broadband/Millimeter-Wave Installation Guide – 10410-00293
- ME7838A Series Modular Broadband/Millimeter-Wave Maintenance Manual – 10410-00306

## Other Documentation

Most VectorStar VNA manuals are available for download as an Adobe Acrobat Portable Document Format (.pdf) file.

The Acrobat Reader program is required to view the manual, and is available free from Adobe at: http://www.adobe.com.

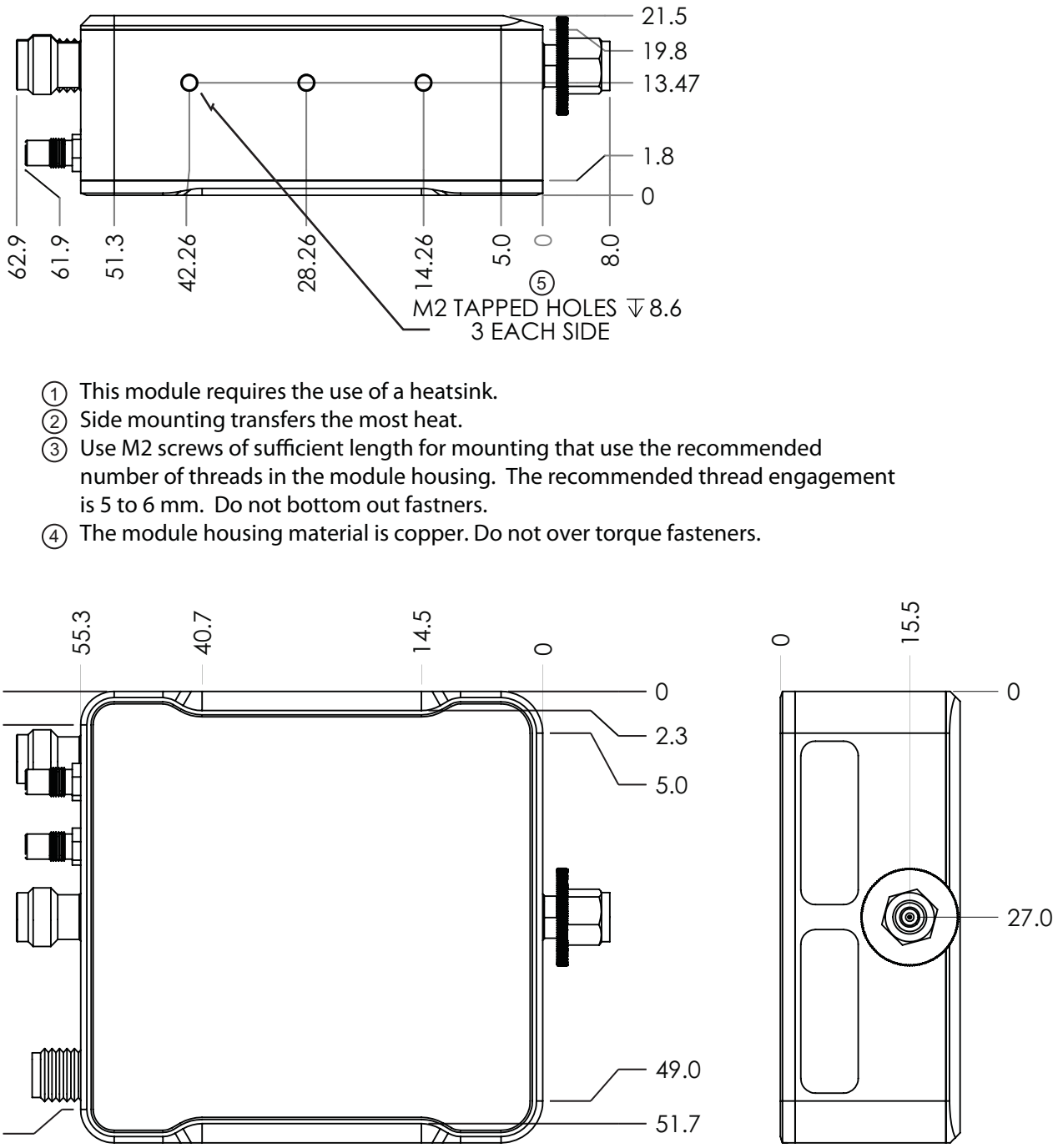
Except for the maintenance manual, all documents are available for free on the Anritsu Internet site.

Printed copies of manuals and the maintenance guide are available for sale at nominal prices. Updates to this manual, if any, may also be downloaded from the Anritsu Internet site at: http://www.us.anritsu.com

# 1-4 Mounting in User-Supplied Bracket

If required, the user can create their own mounting brackets to meet local needs.

Below, Figure 1-3 shows the outline mechanical requirements for the 3743A Millimeter-Wave Modules.




① This module requires the use of a heatsink.
② Side mounting transfers the most heat.
③ Use M2 screws of sufficient length for mounting that use the recommended number of threads in the module housing. The recommended thread engagement is 5 to 6 mm. Do not bottom out fastners.
④ The module housing material is copper. Do not over torque fasteners.

**Figure 1-3.** 3743A Millimeter-Wave Module Outline Drawing (1 of 2)

All dimensions in millimeters.

1 – This module requires the use of a heatsink.

2 – Side mounting is recommended as it transfers the most heat.

3 – For mounting, use M2 screws sufficient length that use the maximum number of module housing threads.
- A thread engagement of 5 to 6 mm is recommended.
- Do not bottom out screws.

4 – The module housing is copper. Do not over torque screws.

5 – The threaded module mounting holes are M2 tapped x 8.6 mm deep, three (3) each side, six (6) total.

**Figure 1-3.** 3743A Millimeter-Wave Module Outline Drawing (2 of 2)

# Chapter 2 — Maintenance Instructions

## 2-1 Introduction

This chapter provides instructions and discussion on the care and use of precision connectors.

| | |
|---|---|
| **Note** | The components in calibration and verification kits are of the highest quality and accuracy. All components are NIST (National Institute of Standards Technology) traceable, which means that the components are very accurate and repeatable. Handle with care. |

## 2-2 Connector Do's and Don'ts

- These are high frequency connectors so be gentle and handle them with care.
- Do not use any part of calibration kit as an "adapter". If you need a special adapter get one from outside of the calibration kit.
- Avoid touching connector mating planes with bare hands. Natural skin oils and microscopic dirt particles are very hard to remove.
- Keep connectors clean.
- When using cotton swaps to clean connectors, make sure that you don't damage the center conductor.
- Always check the pin depth of a new connector before use to determine if they are out of spec. One bad connector can damage many.
- The connector can be damaged by turning in the wrong direction. Turning right tightens and turning left loosens. If you have trouble remembering, use the mnemonic "righty tighty, lefty loosely".
- Always use an appropriate torque wrench.
- Put dust caps on the connector after use.
- Never store adapters loose in a box, in a desk, or in a drawer.
- Calibration kit components are a unique set. Keep them together.

## 2-3 Coaxial Connector Care

Most coax connectors are assembled into a system and forgotten, but some, especially on test equipment are used almost continuously. The care and cleaning of these connectors is critical to accurate and reliable performance. Remember that all connectors have a limited life time and usually a maximum connect/disconnect specification, typically about 5,000 connections. Most will last well beyond this number but poor usage and poor care can destroy a connector well before that number. Good connector performance can be achieved with the following:

- Periodic visual inspection
- Cleaning
- Proper connection and disconnection techniques using torque wrench
- Appropriate gauging techniques

## 2-4 Visual Inspection

To ensure a long and reliable connector life, careful visual inspection should be performed on the connectors before they are used on a particular job at a minimum of once per day when the item is being used. A “good” connector may get damaged if it is mated with a “bad” one.

The minimum magnification for connector inspection for damage varies with the connector:

- 7X for K and V connectors
- 2X for N connectors
- 10X for W1 connectors

Any connector with the following defects should be repaired or discarded:

- Plating
    - Deep scratches showing bare metal on the mating plane
    - Bubbles and blisters
    - The connectors may lose some gloss over time due to usage. Light scratches, marks and other cosmetic imperfections can be found on the mating plane surfaces. These should be of no cause for concern.
- Threads
    - Damaged threads. Don’t force the connectors to mate with each other.
- Center conductors
    - Bent, broken or damaged contacts.

# 2-5 Connector Pin Depth Precautions

A connector should be checked before it is used at a minimum of once per day when in use. If the connector is to be used on another item of equipment, the connector on the equipment to be tested should also be gauged.

Connectors should never be forced together when making a connection since forcing often indicates incorrectness and incompatibility. There are some dimensions that are critical for the mechanical integrity, non-destructive mating and electrical performance of the connector. Connector gauge kits are available for many connector types. Please refer to ***Anritsu Application Note 10200-00040***. The mechanical gauging of coaxial connectors will detect and prevent the following problems:

- Positive pin depth
  - This may result in buckling of the fingers of the female center conductor or damage to the internal structure of a device due to the axial forces generated.
- Negative pin depth
  - This will result in poor return loss, possibly unreliable connections, and could even cause breakdown under peak power conditions.
- These gages should be checked for cleanliness before they are used at a minimum of once per month. The connector cleaning procedures can also be used to clean the pin depth gauges.

## Pin Depth Dimensions

Before mating, measure the pin depth of the device that will mate with the RF component. The dimensions to measure are shown below in Figure 2-1.

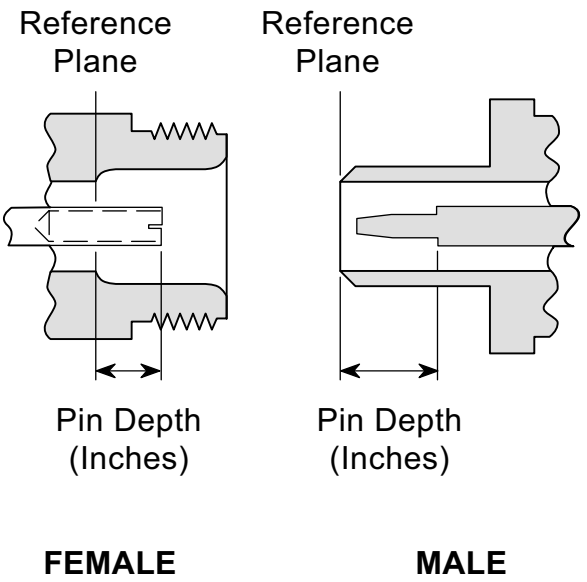
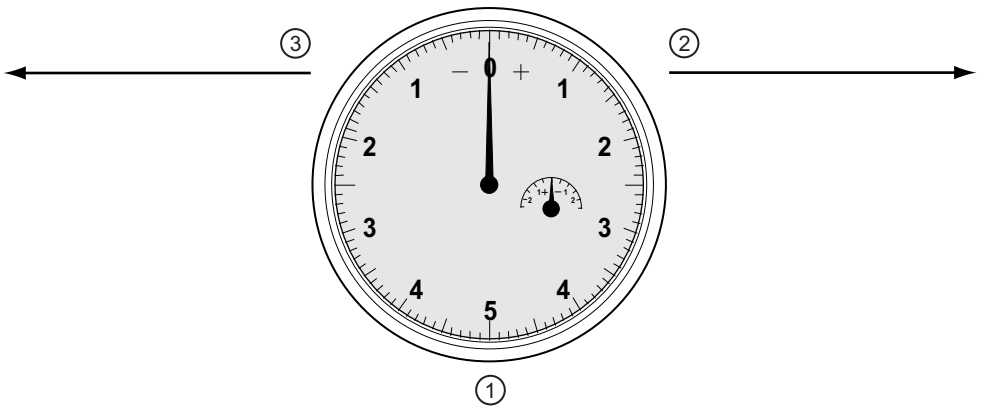



**Figure 2-1.** N Connector Pin Depth

## Pin Depth Gauge

Use an Anritsu Pin Depth Gauge or equivalent as shown below in Figure 2-2 to accurately measure pin depths.




1 – Pin Depth Gauge with needle setting at zero.
2 – Positive needle direction clockwise to right.
3 – Negative needle direction counter-clockwise to left.

**Figure 2-2.** Pin Depth Gauge

Based on RF components returned for repair, destructive pin depth of mating connectors is the major cause of failure in the field. When an RF component is mated with a connector having a destructive pin depth, damage will likely occur to the RF component connector.

| **Note** | A destructive pin depth has a center pin that is too long in respect to the connector's reference plane. |
|---|---|

## Pin Depth Tolerances

The center pin of RF component connectors has a precision tolerance measured in "mils" which is equal to 1/1000 inch (0.001") or approximately 0.02540 mm.

V connectors have a higher precision tolerance measured in "tenths" or 1/10,000 inch (0.0001") or approximately 0.00254 mm.

Connectors on test devices that mate with RF components may not be precision types and may not have the proper depth. They must be measured before mating to ensure suitability and to avoid connector damage.

When gauging pin depth, if the test device connector measures out of tolerance (see Table 2-1 on page 2-4 below) in the "+" region of the gauge (see Figure 2-2 above), the center pin is too long. Mating under this condition will likely damage the termination connector.

On the other hand, if the test device connector measures out of tolerance in the "–" region, the center pin is too short. While this will not cause any damage, it will result in a poor connection and a consequent degradation in performance.

**Table 2-1. Pin Depth Tolerances and Required Torque Settings (1 of 2)**

| Connector Type | Pin Depth (Inches) | Anritsu Gauge Setting |
|---|---|---|
| GPC-7 | +0.000<br>–0.003 | Same as pin depth |

**Table 2-1. Pin Depth Tolerances and Required Torque Settings (2 of 2)**

| Connector Type | Pin Depth (Inches) | Anritsu Gauge Setting |
|---|---|---|
| N Male | 0.207 +0.003 0.000 | 0.207 0.000 –0.003 |
| N Female | 0.207 0.000 –0.003 | 0.207 0.000 –0.003 |
| WSMA Male | –0.0025 | Same as pin depth |
| WSMA Female | –0.0035 | |
| K Male | +0.000 | Same as pin depth |
| K Female | –0.003 | |
| V Male | +0.000 | Same as pin depth |
| V Female | –0.002 | |
| W1 Male | –0.0005 | Same as pin depth |
| W1 Female | –0.0020 | |

## Over Torquing Connectors

Over torquing connectors is destructive; it may damage the connector center pin. Finger-tight is usually sufficient, especially on Type N connectors. *Never* use pliers to tighten connectors. For other connectors, use the correct torque wrench.

## Teflon Tuning Washers

The center conductor on most RF components contains a small teflon tuning washer located near the point of mating (interface). This washer compensates for minor impedance discontinuities at the interface. The washer's location is critical to the RF component's performance. *Do not disturb it.*

## Mechanical Shock

RF components are designed to withstand years of normal bench handling. However, do not drop or otherwise treat them roughly. They are laboratory-quality devices, and like other such devices, they require careful handling.

# 2-6 Connector Cleaning Instructions

Connector interfaces — especially the outer conductors on the GPC 7 and SMA connectors — should be kept clean and free of dirt and other debris.

Denatured alcohol is the recommended solvent. Below, Figure 2-3 illustrates the cleaning procedures for male and female connectors.

| | |
|---|---|
| **Note** | Most cotton swabs are too large to fit into the ends of the smaller connector types. In these cases it is necessary to peel off most of the cotton and then twist the remaining cotton tight. Be sure that the remaining cotton does not get stuck in the connector. |

With continuous use, the outer conductor mating interface will build up a layer of dirt and metal chips that can severely degrade connector electrical and mechanical performance. It also tends to increase the coupling torque which then can damage the mating interface. Cleaning of connectors is essential for maintaining good electrical performance. Therefore, connectors should be checked for cleanliness before making any measurements (or calibration).

## Cleaning Items Required

- Low pressure compressed air (solvent free)
- Cotton swabs
- Isopropyl alcohol
- Microscope

## Important Cleaning Tips

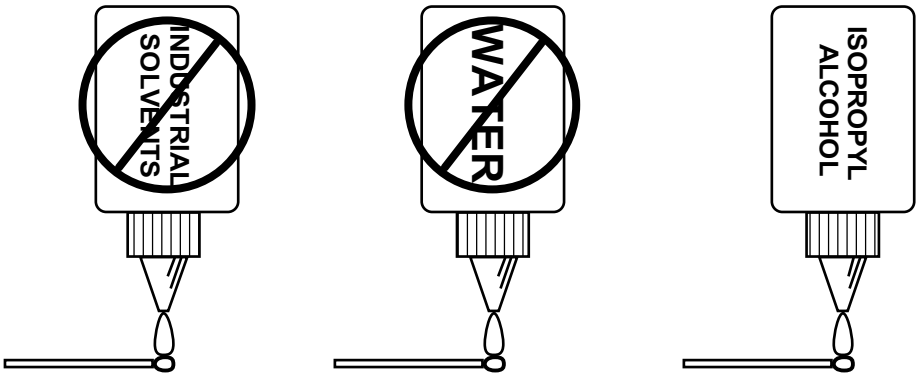
The following are some important tips on cleaning connectors:

- Use only isopropyl alcohol as a solvent.
- Always use an appropriate size of cotton swab.
- Gently move the cotton swab around the center conductor.
- Never put lateral pressure on the connector center pin.
- Verify that no cotton or other foreign material remains in the connector after cleaning.
- Only dampen the cotton swab. Do NOT saturate it.
- Compressed air can be used to remove foreign particles and to dry the connector.
- Verify that the center pin has not been bent or damaged.

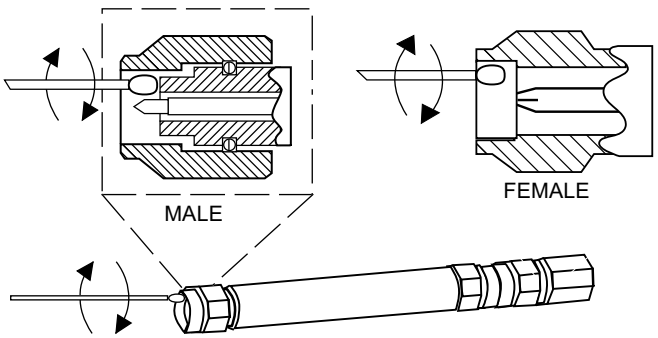
## Cleaning Procedure

1. Remove loose particles on the mating surfaces, threads, and similar surfaces using low-pressure compressed air.
2. The threads of the connector should be cleaned with cotton swab. When connector threads are clean, the connections can be hand-tightened to within approximately one-half turn of the proper torque.
3. Clean mating plane surfaces using alcohol on cotton swabs (Figure 2-3).
   - Make sure that the cotton swab is not too large.
   - Use only enough solvent to clean the surface.
   - Use the least possible pressure to avoid damaging connector surfaces.
   - Do not spray solvents directly on to connector surfaces
4. After cleaning with swabs, again use low-pressure compressed air to remove any remaining small particles and to dry the connector surfaces.

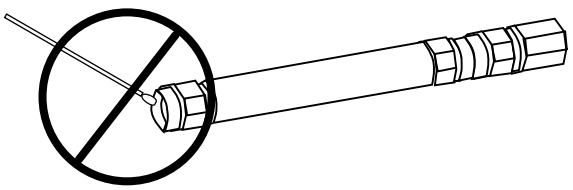
The following Figure 2-3 illustrates how to properly clean connectors.



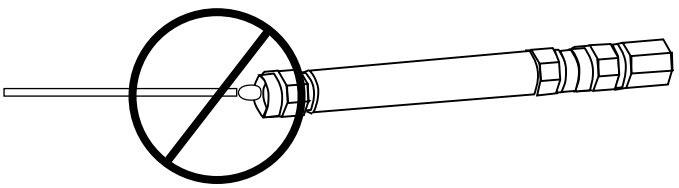

Do NOT use Industrial Solvents or Water on connector. Use only Isopropyl Alcohol. Dampen only, DO NOT saturate.




Use only isopropyl alcohol and the proper size of cotton swab. Gently rotate the swab around the center pin being careful not to stress or bend the pin or you will damage the connector.



Do NOT put cotton swabs in at an angle, or you will damage the connectors.



Do NOT use too large of cotton swab, or you will damage the connectors.

1 – Do NOT use industrial solvents or water on connectors. Use only Isopropyl Alcohol.

2 – Use only isopropyl alcohol and the proper size of cotton swap. Gently rotate the swab around the center pin being careful not to stress or bend the pin or you will damage the connectors.

3 – Do NOT put cotton swabs at an angle, or you will damage the connectors.

4 – Do NOT use too large of cotton swabs, or you will damage the connectors.

**Figure 2-3.** Cleaning Calibration Kit Connectors

# 2-7 Connection and Disconnection Techniques

## Connection Procedure

1. Visually inspect the connectors (see "Visual Inspection").
2. If necessary, clean the connectors (see Figure 2-3 above and "Connector Cleaning Instructions").
3. Carefully align the connectors. The male connector center pin must slip concentrically into the contact fingers of the female connector.
4. Push connectors straight together. Do not twist or screw them together. As the center conductors mate, there is usually a slight resistance.
5. Do not turn the connector body, turn the connector nut instead. Major damage to the center conductor and the outer conductor can occur if the connector body is twisted.
6. Initial tightening can be done by hand.
7. Relieve any side pressure on the connection from long or heavy devices or cables. This assures consistent torque.
8. *Do not* pre-tighten so much that there is no rotation of the nut with the torque wrench. Leave about 1/8 turn or 45 degrees of rotation for the final tightening with the torque wrench.
   - Table 2-2 below lists the Anritsu Company torque wrench and open end wrench part numbers for different connectors.

**Table 2-2.** Connector Wrench Requirements – Torque Wrench Settings – Open End Wrenches

| Connector Type | Torque Wrench Part Number<br>Wrench Size | Torque Specification | End Wrench Part Number<br>Wrench Size |
|---|---|---|---|
| 3.5mm/SMA | 01-201<br>8 mm (5/16") | 0.9 N·m<br>(8 lbf·in) | 01-204<br>8 mm (5/16") |
| K | 01-201<br>8 mm (5/16") | 0.9 N·m<br>(8 lbf·in) | 01-204<br>8 mm (5/16") |
| V | 01-201<br>8 mm (5/16") | 0.9 N·m<br>(8 lbf·in) | 01-204<br>8 mm (5/16") |
| W1 | 01-504<br>6 mm (1/4") | 0.45 N·m<br>(4 lbf·in) | 01-505<br>6 mm / 7 mm |
| SSMC | 01-511<br>4 mm (5/32") | 0.22 N·m<br>(2 lbf·in) | --<br>4 mm (5/32") |

9. Hold torque wrench at the end.
   - Holding the torque wrench elsewhere applies an unknown amount of torque and could damage contacts and/or connectors.
10. Rotate *only* the connector nut when you tighten the connector. Use an open end wrench to keep the body of the connector from turning.
11. Using two wrenches with an angle greater than 90° causes the connector devices to lift up and tends to misalign the devices and stress the connectors. This becomes more of a problem when there are several devices connected to each other.
12. Breaking the handle fully can cause the wrench to kick back and may loosen the connection.

## 2-8 Disconnection Procedure

1. Use an open end wrench to prevent the connector body from turning.
2. Use another wrench to loosen the connector nut.
3. Complete the disconnection by hand, turning *only* the connector nut.
4. Pull the connectors straight apart without twisting or bending.

# Index

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