

# Keysight N9911X Economical Waveguide Calibration Components



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## Manual Part Number

N9911-90002

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# 1 General Information

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## **Overview**

N9911X Economical Waveguide Calibration Components are used to calibrate FieldFox analyzers. With the calibration data properly loaded in the analyzer and a measurement calibration completed, systematic errors are minimized. For information on components available to purchase, refer to the online document *Keysight N9911X Economical Waveguide Calibration Components Configuration Guide* (part number N9911-90003).

## Recording the Components Serial Numbers

The N9911X Economical Waveguide Components are individually serialized (serial numbers are labeled onto the body of each component). Record these serial numbers in the appropriate table. Recording the serial numbers will prevent confusion with similar components.

The N9911X calibration components are manufactured by Flann Microwave. Each component is imprinted with a Flann logo, part ID number, and serial number. To determine the Keysight option number for a component, use the cross-references in the following tables.

**Table 1-1 Serial Number Record, Waveguide Designators C-Band/WR137/WG14, 5.38 – 8.18 GHz**

| Description                                        | Component Serial Number | Keysight Option Number | Flann Part ID Number |
|----------------------------------------------------|-------------------------|------------------------|----------------------|
| <b>Calibration Components – Metric</b>             |                         |                        |                      |
| Adapter 1, waveguide to type-N (male) coax         |                         | N9911X–110             | 14091–NM70–6332      |
| Adapter 2, waveguide to type-N (male) coax         |                         | N9911X–110             | 14091–NM70–6332      |
| Termination                                        |                         | N9911X–111             | 14045–6333           |
| Flush short                                        |                         | N9911X–112             | 14191–6334           |
| ¼ wavelength offset shim                           |                         | N9911X–113             | 14491–02–6335        |
| <b>Calibration Components – English (Imperial)</b> |                         |                        |                      |
| Adapter 1, waveguide to type-N (male) coax         |                         | N9911X–115             | 14091–NM70–6136      |
| Adapter 2, waveguide to type-N (male) coax         |                         | N9911X–115             | 14091–NM70–6136      |
| Termination                                        |                         | N9911X–116             | 14045–3703           |
| Flush short                                        |                         | N9911X–117             | 14191–704            |
| ¼ wavelength offset shim                           |                         | N9911X–118             | 14491–02–3483        |

**Recording the Components Serial Numbers****Table 1-2 Serial Number Record, Waveguide Designator X-Band/WR90/WG16, 8.2 – 12.5 GHz**

| Description                                        | Component<br>Serial Number | Keysight<br>Option Number | Flann<br>Part ID Number |
|----------------------------------------------------|----------------------------|---------------------------|-------------------------|
| <b>Calibration Components – Metric</b>             |                            |                           |                         |
| Adapter 1, waveguide to type-N (male) coax         |                            | N9911X-210                | 16091-NM70-6336         |
| Adapter 2, waveguide to type-N (male) coax         |                            | N9911X-210                | 16091-NM70-6336         |
| Termination                                        |                            | N9911X-211                | 16045-6337              |
| Flush short                                        |                            | N9911X-212                | 16191-6338              |
| $\frac{1}{4}$ wavelength offset shim               |                            | N9911X-213                | 16491-02-6339           |
| <b>Calibration Components – English (Imperial)</b> |                            |                           |                         |
| Adapter 1, waveguide to type-N (male) coax         |                            | N9911X-215                | 16091-NM70-6141         |
| Adapter 2, waveguide to type-N (male) coax         |                            | N9911X-215                | 16091-NM70-6141         |
| Termination                                        |                            | N9911X-216                | 16045-5509              |
| Flush short                                        |                            | N9911X-217                | 16191-2547              |
| $\frac{1}{4}$ wavelength offset shim               |                            | N9911X-218                | 16491-02-2401           |

**Table 1-3 Serial Number Record, Waveguide Designator Ku-Band/WR62/WG18, 11.9 – 18 GHz**

| Description                                        | Component<br>Serial Number | Keysight<br>Option Number | Flann<br>Part ID Number |
|----------------------------------------------------|----------------------------|---------------------------|-------------------------|
| <b>Calibration Components – Metric</b>             |                            |                           |                         |
| Adapter 1, waveguide to type-N (male) coax         |                            | N9911X–310                | 18091–NM–6340           |
| Adapter 2, waveguide to type-N (male) coax         |                            | N9911X–310                | 18091–NM–6340           |
| Termination                                        |                            | N9911X–311                | 18045–6341              |
| Flush short                                        |                            | N9911X–312                | 18191–6342              |
| ¼ wavelength offset shim                           |                            | N9911X–313                | 18491–02–6343           |
| <b>Calibration Components – English (Imperial)</b> |                            |                           |                         |
| Adapter 1, waveguide to type-N (male) coax         |                            | N9911X–315                | 18091–NM–6024           |
| Adapter 2, waveguide to type-N (male) coax         |                            | N9911X–315                | 18091–NM–6024           |
| Termination                                        |                            | N9911X–316                | 18045–2546              |
| Flush short                                        |                            | N9911X–317                | 18191–4127              |
| ¼ wavelength offset shim                           |                            | N9911X–318                | 18491–02–4095           |

**Recording the Components Serial Numbers****Table 1-4 Serial Number Record, Waveguide Designator K-Band/WR42/WG20, 17.6 – 26.7 GHz**

| Description                                        | Component<br>Serial Number | Keysight<br>Option Number | Flann<br>Part ID Number |
|----------------------------------------------------|----------------------------|---------------------------|-------------------------|
| <b>Calibration Components – Metric</b>             |                            |                           |                         |
| Adapter 1, waveguide to 3.5 mm (male) coax         |                            | N9911X–310                | 20091–JM–2371           |
| Adapter 2, waveguide to 3.5 mm (male) coax         |                            | N9911X–310                | 20091–JM–2371           |
| Termination                                        |                            | N9911X–311                | 20045–2376              |
| Flush short                                        |                            | N9911X–312                | 20191–6349              |
| ¼ wavelength offset shim                           |                            | N9911X–313                | 20491–02–6351           |
| <b>Calibration Components – English (Imperial)</b> |                            |                           |                         |
| Adapter 1, waveguide to 3.5 mm (male) coax         |                            | N9911X–315                | 20091–JM–2372           |
| Adapter 2, waveguide to 3.5 mm (male) coax         |                            | N9911X–315                | 20091–JM–2372           |
| Termination                                        |                            | N9911X–316                | 20045–5174              |
| Flush short                                        |                            | N9911X–317                | 20191–6348              |
| ¼ wavelength offset shim                           |                            | N9911X–318                | 20491–02–6350           |

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## Preventive Maintenance

The best techniques for maintaining the integrity of the components include:

- routine visual inspection
- routine cleaning
- proper connection techniques

All of these are described in [Chapter 3](#). Failure to detect and remove dirt or metallic particles on a mating plane surface can degrade repeatability and accuracy and can damage any component mated to it. Improper connections resulting from poor connection techniques, can also damage these components.

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## When to Calibrate the Analyzer

An analyzer calibration remains valid as long as the changes in the systematic error are insignificant. This means that changes to the uncorrected leakages (directivity and isolation), mismatches (source match and load match), and frequency response of the system are small (<10%) relative to accuracy specifications.

Change in the environment (especially temperature) between calibration and measurement is the major cause in calibration accuracy degradation. The major effect is a change in the physical length of external and internal cables. Other important causes are dirty and damaged test port connectors and calibration standards. If the connectors become dirty or damaged, measurement repeatability and accuracy is affected. Fortunately, it is relatively easy to evaluate the general validity of the calibration. To test repeatability, remeasure one of the calibration standards. If you can not obtain repeatable measurements from your calibration standards, maintenance needs to be performed on the test port connectors, cables and calibration standards. Also, maintain at least one sample of the device under test or some known device as your reference device.

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## How to Calibrate the Analyzer

Your analyzer's calibration user interface prompts you through each step in a 1-port or a 2-port calibration procedure. For detailed information on using your analyzer, refer to the appropriate user guide. See ["Where to Look for More Information"](#) on page 4-3.





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## **2 Specifications**

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## Environmental Requirements

Table 2-1 Environmental Requirements

| Parameter              | Limits           |
|------------------------|------------------|
| Temperature            |                  |
| Operating <sup>1</sup> | +4 °C to +40 °C  |
| Storage                | -20 °C to +70 °C |

1. The temperature range over which the calibration components maintain performance to their specifications.

### Temperature—What to Watch Out For

Changes in temperature can affect electrical characteristics. Therefore, the operating temperature is a critical factor in performance. During a measurement calibration, the temperature of the calibration components must be stable and within the range shown in

Table 2-1.

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**IMPORTANT**    Avoid unnecessary handling of the components during calibration because your fingers act as a heat source and may increase the temperature of the component.

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## Typical VSWR Values

Table 2-2 and Table 2-3 list the typical VSWR values for the N9911X terminations and waveguide-to-coax adapters.

**Table 2-2 Typical VSWR Values for Terminations**

| Keysight Option Number for Termination | Waveguide Band Designator | Thread Type        | Frequency        | VSWR, Maximum |
|----------------------------------------|---------------------------|--------------------|------------------|---------------|
| N9911X-111                             | C-Band, WR137, WG14       | Metric             | 5.38 to 8.18 GHz | 1.10          |
| N9911X-116                             |                           | English (Imperial) |                  | 1.02          |
| N9911X-211                             | X-Band, WR90, WG16        | Metric             | 8.2 to 12.5 GHz  | 1.02          |
| N9911X-216                             |                           | English (Imperial) |                  |               |
| N9911X-311                             | Ku-Band, WR62, WG18       | Metric             | 11.9 to 18 GHz   | 1.02          |
| N9911X-316                             |                           | English (Imperial) |                  |               |
| N9911X-411                             | K-Band, WR42, WG20        | Metric             | 17.6 to 26.7GHz  | 1.03          |
| N9911X-416                             |                           | English (Imperial) |                  |               |

**Table 2-3 Typical VSWR Values for Waveguide-to-Coax Adapters**

| Keysight Option Number for Adapter | Waveguide Band Designator | Thread Type        | Frequency        | VSWR, Maximum |
|------------------------------------|---------------------------|--------------------|------------------|---------------|
| N9911X-110                         | C-Band, WR137, WG14       | Metric             | 5.38 to 8.18 GHz | 1.10          |
| N9911X-115                         |                           | English (Imperial) |                  |               |
| N9911X-210                         | X-Band, WR90, WG16        | Metric             | 8.2 to 12.5 GHz  | 1.10          |
| N9911X-215                         |                           | English (Imperial) |                  |               |
| N9911X-310                         | Ku-Band, WR62, WG18       | Metric             | 11.9 to 18 GHz   | 1.10          |
| N9911X-315                         |                           | English (Imperial) |                  |               |
| N9911X-410                         | K-Band, WR42, WG20        | Metric             | 17.6 to 26.7GHz  | 1.20          |
| N9911X-415                         |                           | English (Imperial) |                  |               |

## Instrument Interface Specifications

**Table 2-4 N9911X Instrument Interface Specifications**

| Waveguide Band Designator | Thread Type        | Compatible Flange Type                                                                                                                                                                            |
|---------------------------|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| C-Band/<br>WR137/<br>WG14 | Metric             | Flange (UAR 70, PAR 70, CAR 70, UDR 70, RDR 70, PDR 70)                                                                                                                                           |
|                           | English (Imperial) | Flange (UG-441/U, UG-344/U, UG-343B/U, UG-440B/U, UG-1733/U, UG-1732/U, UG-1356/U, UG-1357/U, CPR 137F, CPR 137G)                                                                                 |
| X-Band/<br>WR90/<br>WG16  | Metric             | Flange (UBR 100, PBR 100, CBR 100, UDR 100, PDR 100, RDR 100)                                                                                                                                     |
|                           | English (Imperial) | Flange (UG-39/U, UG-135/U, M3922/53-009, M3922/53-010, M3922/53-015, M3922/53-016, UG-40B/U, UG-136B/U, M3922/59-013, M3922/59-014, UG-1736/U, UG-1737/U, UG-1360/U, UG-1361/U, CPR 90F, CPR 90G) |
| Ku-Band/<br>WR62/<br>WG18 | Metric             | Flange (UBR 140, PBR 140, CBR 140, UDR 140, PDR 140, RDR 140)                                                                                                                                     |
|                           | English (Imperial) | Flange (UG-419A/U, UG-1665/U, M3922/53-011, M3922/53-012, M3922/53-017, M3922/53-018, UG-541A/U, UG-1666/U)                                                                                       |
| K-Band/<br>WR42/<br>WG20  | Metric             | Flange (UBR 220, PBR 220, CBR 220, UDR 220, PDR 220, RDR 220)                                                                                                                                     |
|                           | English (Imperial) | Flange (UG-595/U, UG-597/U, UG596A/U, UG-598A/U, M3922/70-027, M3922/70-028)                                                                                                                      |

## Dimension Specifications

**Table 2-5 N9911X Dimension Specifications**

| Component                  | Parameter                    | WR137                                | WR90                               | WR62                                | WR42                                |
|----------------------------|------------------------------|--------------------------------------|------------------------------------|-------------------------------------|-------------------------------------|
| Adapter, waveguide-to-coax | Waveguide aperture tolerance | 46 um MAX                            | 25 um MAX                          | 23 um MAX                           | 20 um MAX                           |
| Termination                | Waveguide aperture tolerance | 46 um MAX                            | 25 um MAX                          | 23 um MAX                           | 20 um MAX                           |
| Flush short                | Shorting face flatness       | 25 um                                | 25 um                              | 25 um                               | 25 um                               |
| 1/4 wavelength offset shim | Waveguide aperture tolerance | 46 um MAX,<br>14.711 mm<br>+/- 45 um | 25 um MAX,<br>9.63 mm<br>+/- 35 um | 23 um MAX,<br>6.668 mm<br>+/- 30 um | 20 um MAX,<br>4.501 mm<br>+/- 25 um |

**NOTE** Refer to the Appendix for graphics showing the component dimensions.



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## **3 Use, Maintenance, and Care of the Components**

**Electrostatic Discharge**

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## Electrostatic Discharge

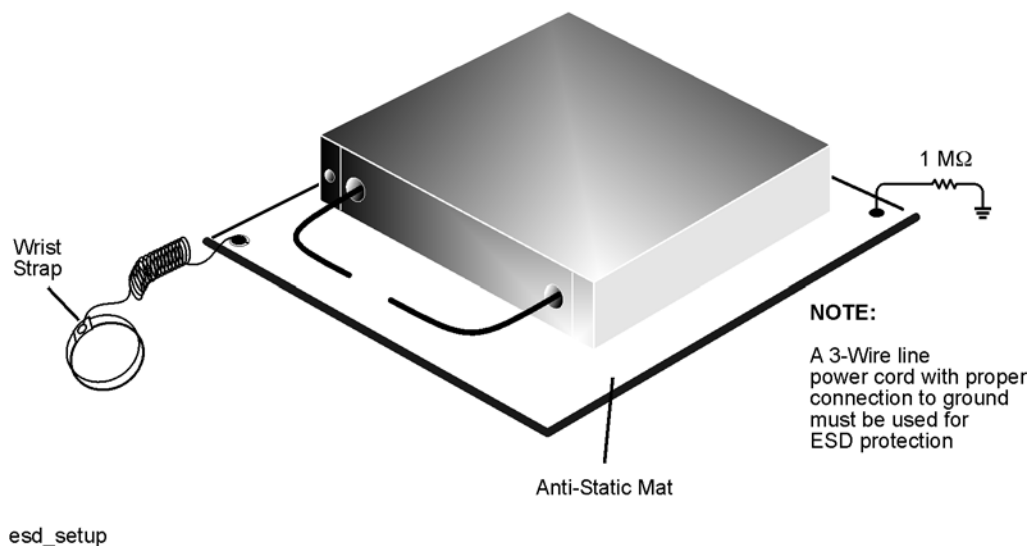
Protection against electrostatic discharge (ESD) is essential while connecting, inspecting, or cleaning connectors attached to a static-sensitive circuit (such as those found in test sets).

Static electricity can build up on your body and can easily damage sensitive internal circuit elements when discharged. Static discharges too small to be felt can cause permanent damage. Devices such as calibration components and devices under test (DUT), can also carry an electrostatic charge. To prevent damage to the test set, components, and devices:

- *always* wear a grounded wrist strap having a 1 MW resistor in series with it when handling components and devices or when making connections to the test set.
- *always* use a grounded antistatic mat in front of your test equipment.
- *always* wear a heel strap when working in an area with a conductive floor. If you are uncertain about the conductivity of your floor, wear a heel strap.
- *always* ground yourself before you clean, inspect, or make a connection to a static-sensitive device or test port. You can, for example, grasp the grounded outer shell of the test port or cable connector briefly.
- *always* ground the center conductor of a test cable before making a connection to the analyzer test port or other static-sensitive device. This can be done as follows:
  1. Connect a short to one end of the cable to short the center conductor to the outer conductor.
  2. While wearing a grounded wrist strap, grasp the outer shell of the cable connector.
  3. Connect the other end of the cable to the test port.
- Remove the short from the cable.

**Figure 3-1** shows a typical ESD protection setup using a grounded mat and wrist strap.

**Figure 3-1 ESD Protection Setup**





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## **Visual Inspection**

Visual inspection and, if necessary, cleaning should be done every time a connection is made. Inspect mating surfaces for dirt, dust, foreign particles, or scratches, which can degrade component performance. A damaged mating surface can damage any good surface connected to it. If necessary, clean all mating surfaces.

Magnification is helpful when inspecting mating surfaces, but it is not required and may actually be misleading. Defects and damage that cannot be seen without magnification generally have no effect on electrical or mechanical performance. Magnification is of great use in analyzing the nature and cause of damage and in cleaning mating surfaces, but it is not required for inspection.

---

## Cleaning the Mating Plane Surfaces

### 1. Use Compressed Air or Nitrogen

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**WARNING** Always use protective eyewear when using compressed air or nitrogen.

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Use compressed air (or nitrogen) to loosen particles on the mating plane surfaces. Clean air cannot damage a component or leave particles or residues behind.

You can use any source of clean, dry, low-pressure compressed air or nitrogen that has an effective oil-vapor filter and liquid condensation trap placed just before the outlet hose.

Ground the hose nozzle to prevent electrostatic discharge, and set the air pressure to less than 414 kPa (60 psi) to control the velocity of the air stream. High-velocity streams of compressed air can cause electrostatic effects when directed into a component. These electrostatic effects can damage the component. Refer to “**Electrostatic Discharge**” earlier in this chapter for additional information.

---

**WARNING** Keep isopropyl alcohol away from heat, sparks, and flame. Store in a tightly closed container. It is extremely flammable. In case of fire, use alcohol foam, dry chemical, or carbon dioxide; water may be ineffective.

Use isopropyl alcohol with adequate ventilation and avoid contact with eyes, skin, and clothing. It causes skin irritation, may cause eye damage, and is harmful if swallowed or inhaled. It may be harmful if absorbed through the skin. Wash thoroughly after handling.

In case of spill, soak up with sand or earth. Flush spill area with water.

Dispose of isopropyl alcohol in accordance with all applicable federal, state, and local environmental regulations.

---

### 2. Clean the Mating Plane Surfaces

- a. Apply a small amount of isopropyl alcohol to a lint-free cleaning swab.
- b. Clean the mating plane surfaces.
- c. Let the alcohol evaporate, then blow the mating plane surface dry with a gentle stream of clean, low-pressure compressed air or nitrogen. Always completely dry a component before you reassemble or use it.

### 3. Inspect

- a. Inspect the mating plane surface to make sure that no particles or residue remain. “**Visual Inspection**” on page 3-3.

---

## Connections

Good connections require a skilled operator. Slight errors in operator technique can have a significant effect on measurements and measurement uncertainties. *The most common cause of measurement error is poor connections.*

The following procedures illustrate how to make good connections.

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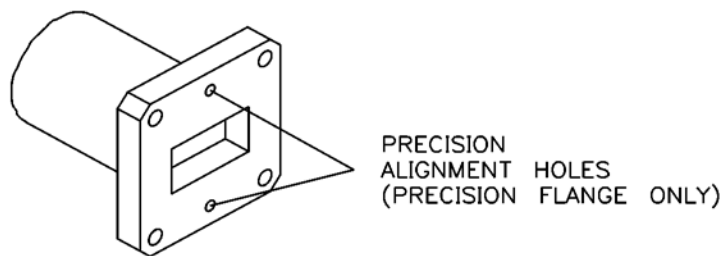
**IMPORTANT** Unlike threaded components, the WR-90, WR-62, WR-42 waveguide mating planes are flanges that you must carefully screw together. Always connect waveguide in the same flange orientation. For example, use the label as a reference and always connect components with the labels facing the same direction.

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### Aligning Two Precision Flanges

A precision flange has two precision alignment holes, as shown in [Figure 3-2](#). A non-precision flange has only screw holes.

**Figure 3-2** Precision Alignment Holes

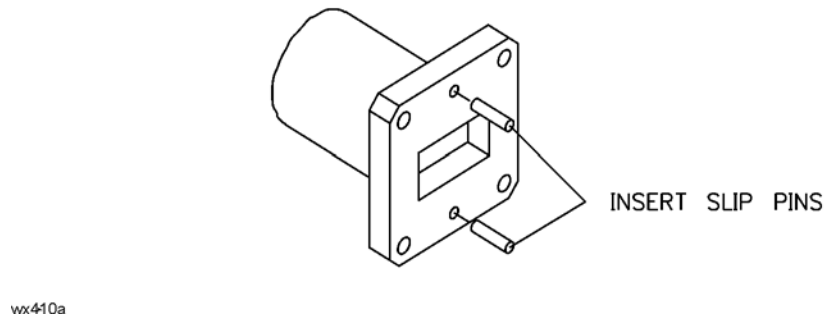


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## Connections

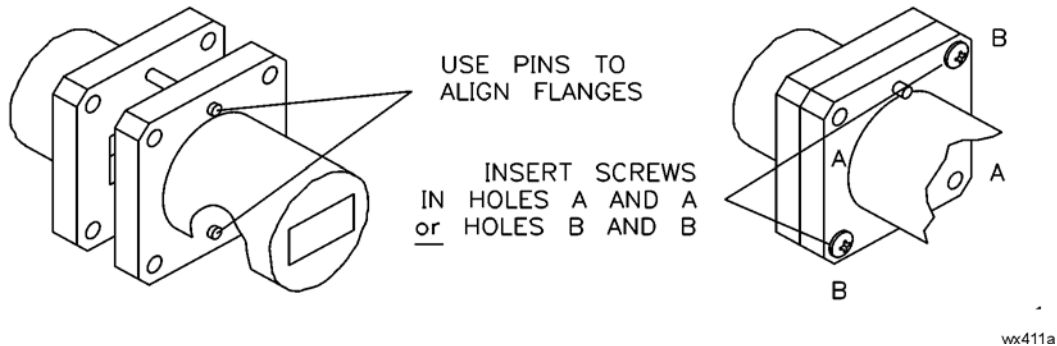
1. Place the slip pins in the top and bottom holes of one flange, as shown in **Figure 3-3**.

**Figure 3-3** Inserting Slip Pins



2. Using the pins as guides for the adapter, offset shim, and waveguide-to-coax adapter, carefully align the flanges and insert two screws in the diagonal corner holes, as shown in **Figure 3-4**.

**Figure 3-4** Aligning Flanges



3. Place a lock washer and nut on each screw, and finger tighten.
4. Insert the remaining two screws.
5. Place a lock washer and nut on each screw, and finger tighten.
6. Remove the slip pins.
7. Go to **"Tightening a Flange Connection"** on page 3-7.

## Tightening a Flange Connection

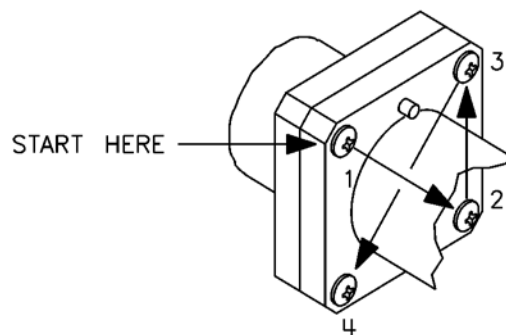
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**NOTE** The best connection has symmetrical pressure applied as you gradually tighten the screws.

---

1. In an "X" pattern (for equal compression), tighten all four screws using a hex ball driver. Do *not* over-tighten. See **Figure 3-5**.
2. Visually inspect the connection. Refer to the following section "**Inspecting a Flange Connection**."

**Figure 3-5** "X" Screw Pattern



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## Inspecting a Flange Connection

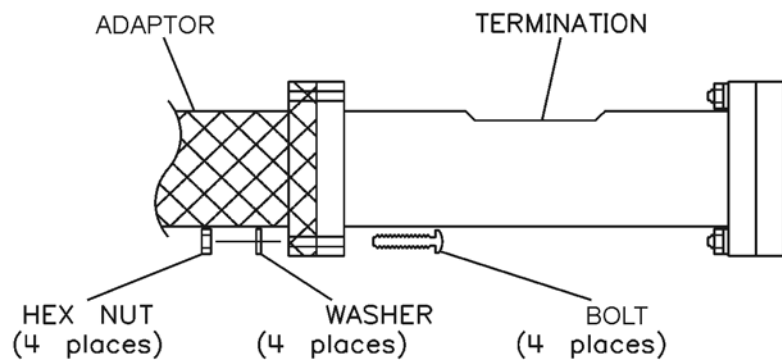
Inspect the flange connection as follows:

1. Place an electric light or white paper behind the connection.
2. Check the flange matings for any gap. A good connection has no gaps between the connected waveguide flanges, and the waveguide walls are flush. There is no step or offset.
3. Ensure that all four screws are equally tight.

## Connections

### Connecting a Termination to a Waveguide-to-Coax Adapter

**Figure 3-6** Termination and Adapter

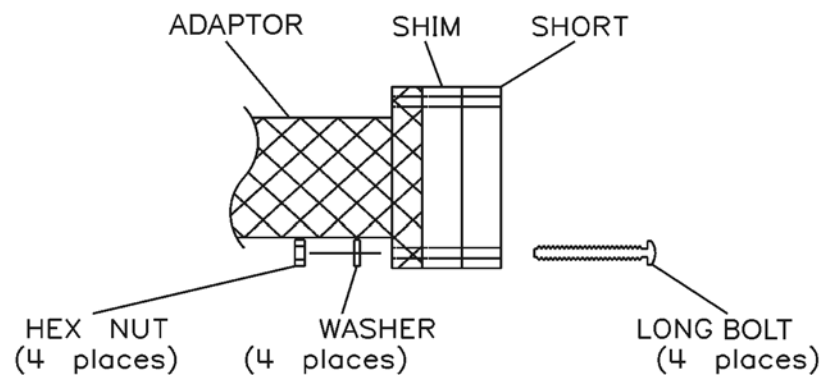


wx403a

### Connecting an Offset Shim Between a Flush Short and Waveguide-to-Coax Adapter

Create an offset short by connecting the offset shim between the short and the appropriate adapter, as shown in [Figure 3-7](#).

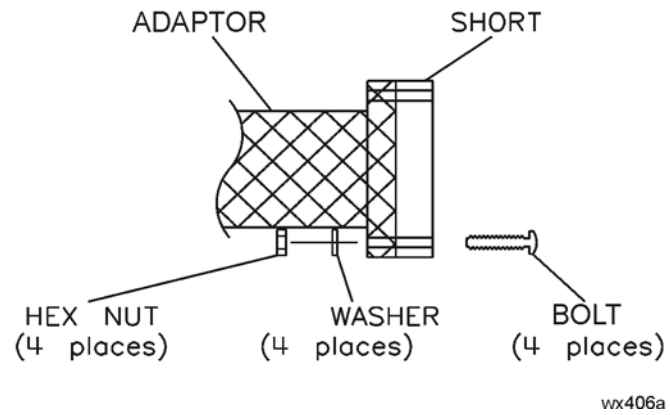
**Figure 3-7** Shim, Flush Short, and Adapter (Creates an Offset Short)



wx405a

## Connecting a Flush Short to a Waveguide-to-Coax Adapter

**Figure 3-8** Flush Short and Adapter



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## **Handling and Storage**

- Install the protective end caps and store the calibration components when not in use.
- Never store components loose in a box, or in a desk or bench drawer. This is the most common cause of component damage during storage.
- Keep components clean.
- Do not touch mating plane surfaces. Natural skin oils and microscopic particles of dirt are easily transferred to a component and are very difficult to remove.
- Do not set components contact-end down on a hard surface. The plating and the mating plane surfaces can be damaged if the interface comes in contact with any hard surface.



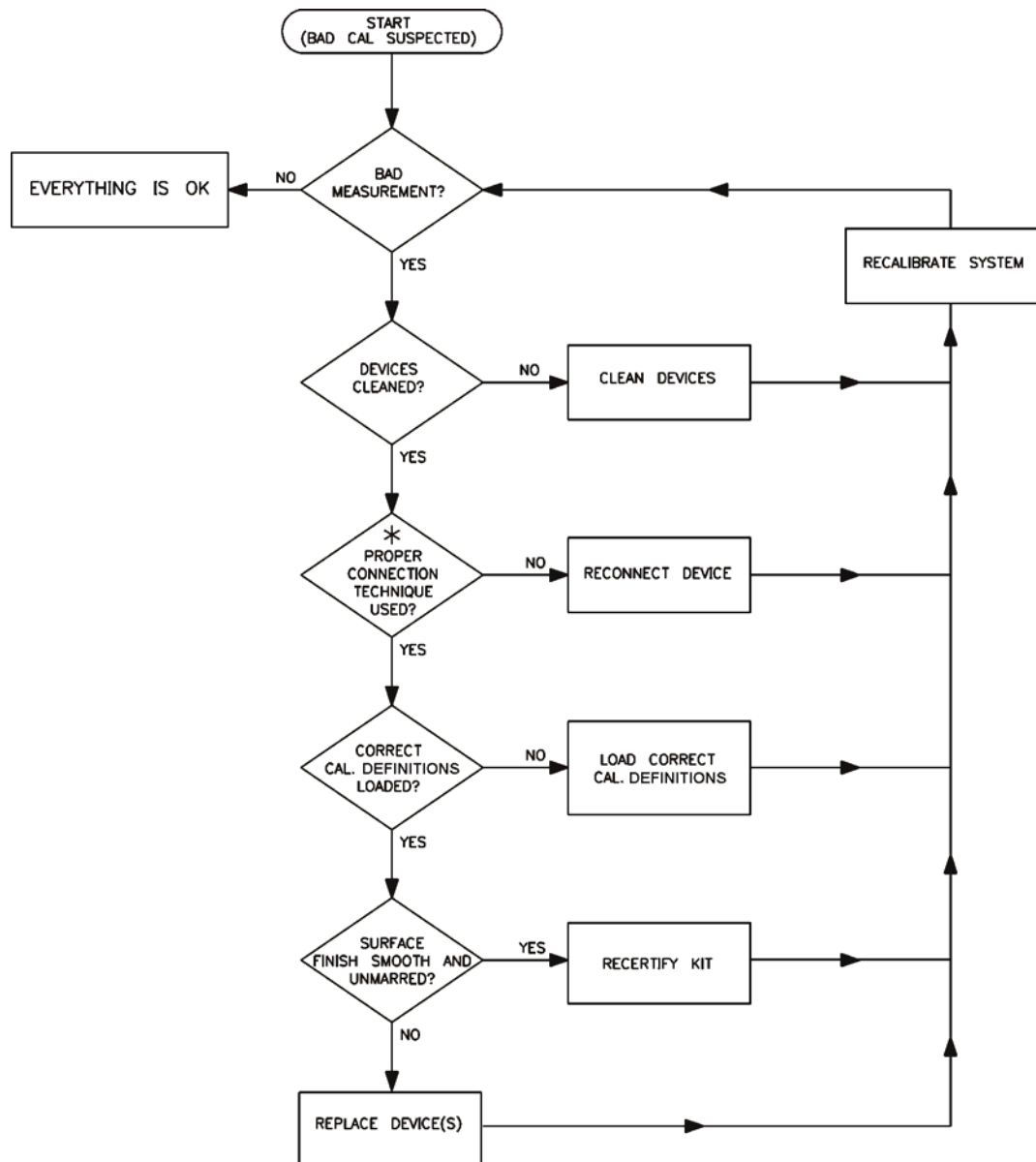
---

## **4 Troubleshooting**

## Troubleshooting Process

If you suspect a bad calibration, or if your analyzer does not pass performance verification, follow the steps in [Figure 4-1](#)

**Figure 4-1 Troubleshooting Flowchart**



\* NO GAPS; WAVEGUIDE WALLS FLUSH;  
EVEN AND SYMMETRICAL TIGHTENING.

wx416a

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## Where to Look for More Information

This manual contains limited information about analyzer system operation. For detailed information on using a FieldFox analyzer, refer to the appropriate user guide.

To view an online FieldFox user guide, use the following steps:

1. Go to *www.keysight.com*.
2. Enter your FieldFox model number (Ex: N9928A) in the Search box and click **Search**.
3. Click **Manuals**.
4. Click the title/hyperlink for the document PDF you want to view.

If you need additional information, see [“Contacting Keysight” on page 4-4](#).

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## Returning a Component to Keysight

If an N9911X component requires service, contact Keysight Technologies for information on where to send it - see [“Contacting Keysight” on page 4-4](#). Please provide the following information:

- your company name and address
- a technical contact person within your company, and the person's complete telephone number
- the Keysight option number, Flann part ID number, and serial number of the component (refer to [“Recording the Components Serial Numbers” on page 1-3](#))
- the type of service required
- a *detailed* description of the problem and how the component was being used when the problem occurred

---

|             |                                                                                           |
|-------------|-------------------------------------------------------------------------------------------|
| <b>NOTE</b> | When returning a component to Keysight, install the protective end caps on the component. |
|-------------|-------------------------------------------------------------------------------------------|

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## Contacting Keysight

Assistance with test and measurement needs and information on finding a local Keysight office are available on the Web at:

[www.keysight.com/find/assist](http://www.keysight.com/find/assist)

If you do not have access to the Internet, please contact your Keysight field engineer.

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|             |                                                                                                                                                                                                                                                       |
|-------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>NOTE</b> | In any correspondence or telephone conversation, refer to the Keysight product by its model number and full serial number. With this information, the Keysight representative can determine whether your product is still within its warranty period. |
|-------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

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## **5 Component Dimensions**

**Table 5-1 List of Figures**

| <b>Figure Title and Location</b>                                                                                     |
|----------------------------------------------------------------------------------------------------------------------|
| "Flange, Waveguide Designators C-Band/WR137/WG14, Metric" on page 5-5                                                |
| "Flange, Waveguide Designators C-Band/WR137/WG14, English (Imperial)" on page 5-6                                    |
| "Flange, Waveguide Designators X-Band/WR90/WG16, Metric" on page 5-6                                                 |
| "Flange, Waveguide Designators X-Band/WR90/WG16, English (Imperial)" on page 5-7                                     |
| "Flange, Waveguide Designators Ku-Band/WR62/WG18, Metric" on page 5-7                                                |
| "Flange, Waveguide Designators Ku-Band/WR62/WG18, English (Imperial)" on page 5-8                                    |
| "Flange, Waveguide Designators K-Band/WR42/WG20, Metric" on page 5-8                                                 |
| "Flange, Waveguide Designators K-Band/WR42/WG20, English (Imperial)" on page 5-9                                     |
| "Adapter, Waveguide Designators C-Band/WR137/WG14, Metric, Keysight Part Number N9911X-110" on page 5-10             |
| "Adapter, Waveguide Designators C-Band/WR137/WG14, English (Imperial), Keysight Part Number N9911X-115" on page 5-11 |
| "Adapter, Waveguide Designators X-Band/WR90/WG16, Metric, Keysight Part Number N9911X-210" on page 5-12              |
| "Adapter, Waveguide Designators X-Band/WR90/WG16, English (Imperial), Keysight Part Number N9911X-215" on page 5-13  |
| "Adapter, Waveguide Designators Ku-Band/WR62/WG18, Metric, Keysight Part Number N9911X-310" on page 5-14             |
| "Adapter, Waveguide Designators Ku-Band/WR62/WG18, English (Imperial), Keysight Part Number N9911X-315" on page 5-15 |
| "Adapter, Waveguide Designators K-Band/WR42/WG20, Metric, Keysight Part Number N9911X-410" on page 5-16              |
| "Adapter, Waveguide Designators K-Band/WR42/WG20, English (Imperial), Keysight Part Number N9911X-415" on page 5-17  |
| "Termination, Waveguide Designators C-Band/WR137/WG14, Metric, Keysight Part Number N9911X-111" on page 5-18         |

**Table 5-1 List of Figures**

| <b>Figure Title and Location</b>                                                                                         |
|--------------------------------------------------------------------------------------------------------------------------|
| "Termination, Waveguide Designators C-Band/WR137/WG14, English (Imperial), Keysight Part Number N9911X-116" on page 5-19 |
| "Termination, Waveguide Designators X-Band/WR90/WG16, Metric, Keysight Part Number N9911X-211" on page 5-20              |
| "Termination, Waveguide Designators X-Band/WR90/WG16, English (Imperial), Keysight Part Number N9911X-216" on page 5-21  |
| "Termination, Waveguide Designators Ku-Band/WR62/WG18, Metric, Keysight Part Number N9911X-311" on page 5-22             |
| "Termination, Waveguide Designators Ku-Band/WR62/WG18, English (Imperial), Keysight Part Number N9911X-316" on page 5-23 |
| "Termination, Waveguide Designators K-Band/WR42/WG20, Metric, Keysight Part Number N9911X-411" on page 5-24              |
| "Termination, Waveguide Designators K-Band/WR42/WG20, English (Imperial), Keysight Part Number N9911X-416" on page 5-25  |
| "Offset Shim, Waveguide Designators C-Band/WR137/WG14, Metric, Keysight Part Number N9911X-113" on page 5-26             |
| "Offset Shim, Waveguide Designators C-Band/WR137/WG14, English (Imperial), Keysight Part Number N9911X-118" on page 5-27 |
| "Offset Shim, Waveguide Designators X-Band/WR90/WG16, Metric, Keysight Part Number N9911X-213" on page 5-28              |
| "Offset Shim, Waveguide Designators X-Band/WR90/WG16, English (Imperial), Keysight Part Number N9911X-218" on page 5-29  |
| "Offset Shim, Waveguide Designators Ku-Band/WR62/WG18, Metric, Keysight Part Number N9911X-313" on page 5-30             |
| "Offset Shim, Waveguide Designators Ku-Band/WR62/WG18, English (Imperial), Keysight Part Number N9911X-318" on page 5-31 |
| "Offset Shim, Waveguide Designators K-Band/WR42/WG20, Metric, Keysight Part Number N9911X-413" on page 5-32              |
| "Offset Shim, Waveguide Designators K-Band/WR42/WG20, English (Imperial), Keysight Part Number N9911X-418" on page 5-33  |
| "Flush Short, Waveguide Designators C-Band/WR137/WG14, Metric, Keysight Part Number N9911X-112" on page 5-34             |

**Table 5-1 List of Figures**

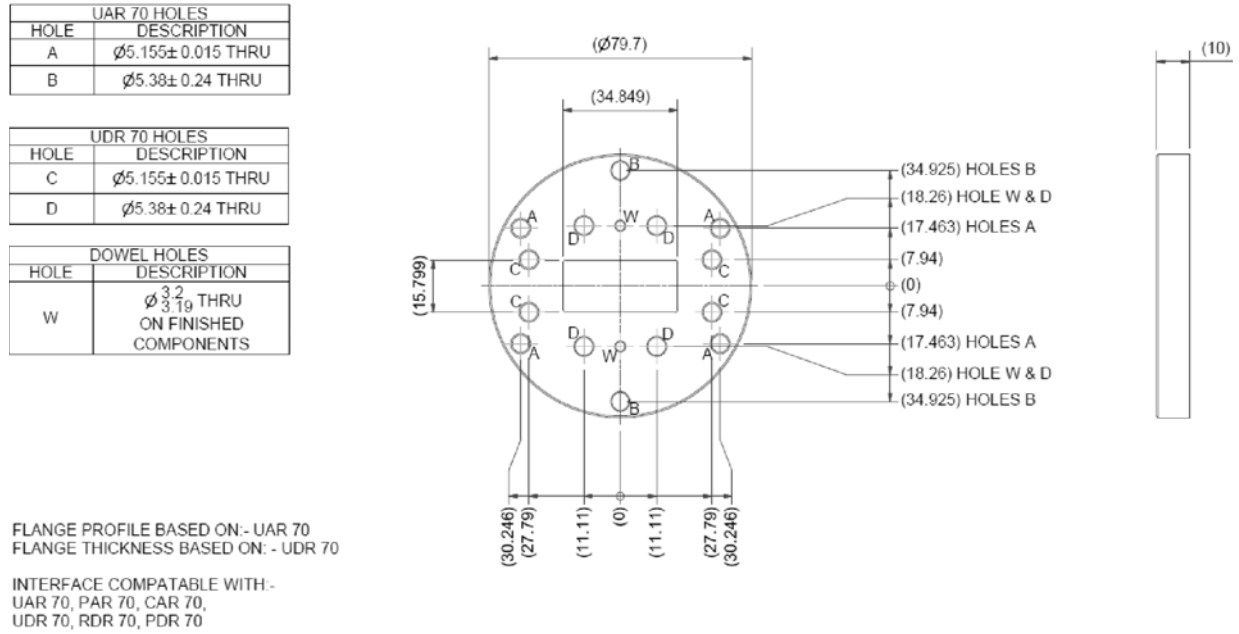
| Figure Title and Location                                                                                                |
|--------------------------------------------------------------------------------------------------------------------------|
| "Flush Short, Waveguide Designators C-Band/WR137/WG14, English (Imperial), Keysight Part Number N9911X-117" on page 5-35 |
| "Flush Short, Waveguide Designators X-Band/WR90/WG16, Metric, Keysight Part Number N9911X-212" on page 5-36              |
| "Flush Short, Waveguide Designators X-Band/WR90/WG16, English (Imperial), Keysight Part Number N9911X-217" on page 5-37  |
| "Flush Short, Waveguide Designators Ku-Band/WR62/WG18, Metric, Keysight Part Number N9911X-312" on page 5-38             |
| "Flush Short, Waveguide Designators Ku-Band/WR62/WG18, English (Imperial), Keysight Part Number N9911X-317" on page 5-39 |
| "Flush Short, Waveguide Designators K-Band/WR42/WG20, Metric, Keysight Part Number N9911X-412" on page 5-40              |
| "Flush Short, Waveguide Designators K-Band/WR42/WG20, English (Imperial), Keysight Part Number N9911X-417" on page 5-41  |



## Flange Dimensions

**NOTE** The dimensions shown in the following graphics are in millimeters.

**Figure 5-1 Flange, Waveguide Designators C-Band/WR137/WG14, Metric**



N9911\_002\_201

## Flange Dimensions

### Figure 5-2 Flange, Waveguide Designators C-Band/WR137/WG14, English (Imperial)

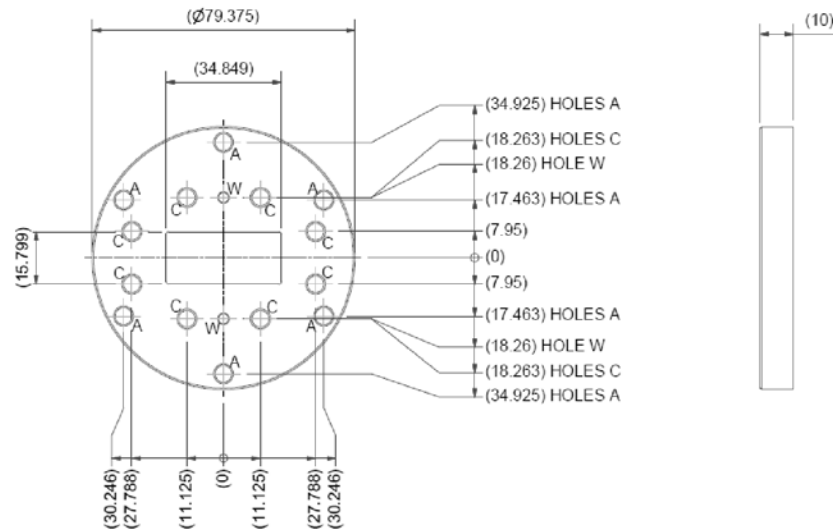
| UG-344/U HOLES |                   |
|----------------|-------------------|
| HOLE           | DESCRIPTION       |
| A              | Ø5.105± 0.05 THRU |

| UG-1732/U HOLES |                  |
|-----------------|------------------|
| HOLE            | DESCRIPTION      |
| C               | Ø5.029±0.05 THRU |

| DOWEL HOLES |                                                              |
|-------------|--------------------------------------------------------------|
| HOLE        | DESCRIPTION                                                  |
| W           | $\varnothing_{3.19}^{3.2}$ THRU<br>ON FINISHED<br>COMPONENTS |

FLANGE PROFILE BASED ON:- UG-344/U  
FLANGE THICKNESS BASED ON:- UDR 70

INTERFACE COMPATABLE WITH:-  
UG-344/U, UG-441/U,  
UG-343B/U, UG-440B/U  
UG-1732/U, UG-1733/U, UG-1356/U, UG-1357/U,  
CPR 137 F, CPR 137 G



N9911\_002\_202

### Figure 5-3 Flange, Waveguide Designators X-Band/WR90/WG16, Metric

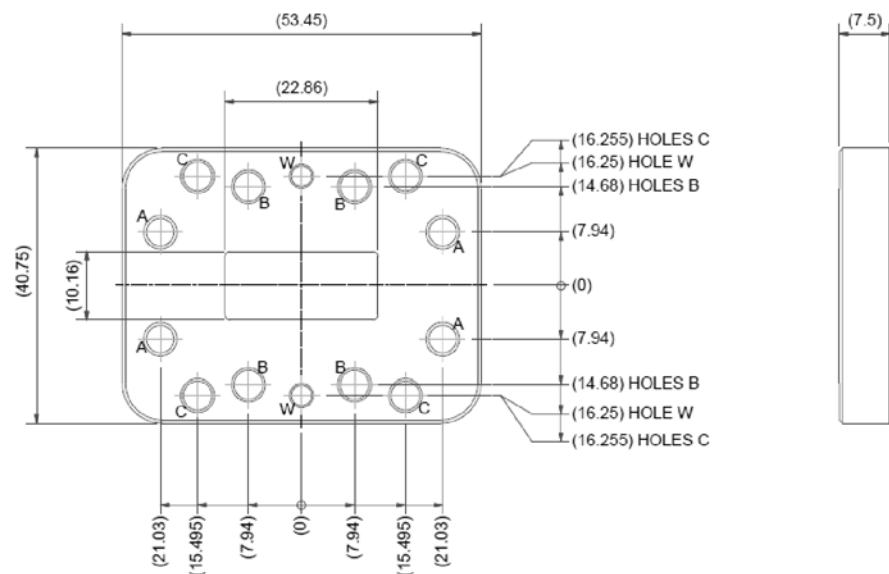
| UDR 100 HOLES |                    |
|---------------|--------------------|
| HOLE          | DESCRIPTION        |
| A             | Ø4.085± 0.015 THRU |
| B             | Ø4.31± 0.24 THRU   |

| UBR 100 HOLES |                   |
|---------------|-------------------|
| HOLE          | DESCRIPTION       |
| C             | Ø4.255±0.015 THRU |

| DOWEL HOLES |                                                 |
|-------------|-------------------------------------------------|
| HOLE        | DESCRIPTION                                     |
| W           | Ø 3.2<br>3.19 THRU<br>ON FINISHED<br>COMPONENTS |

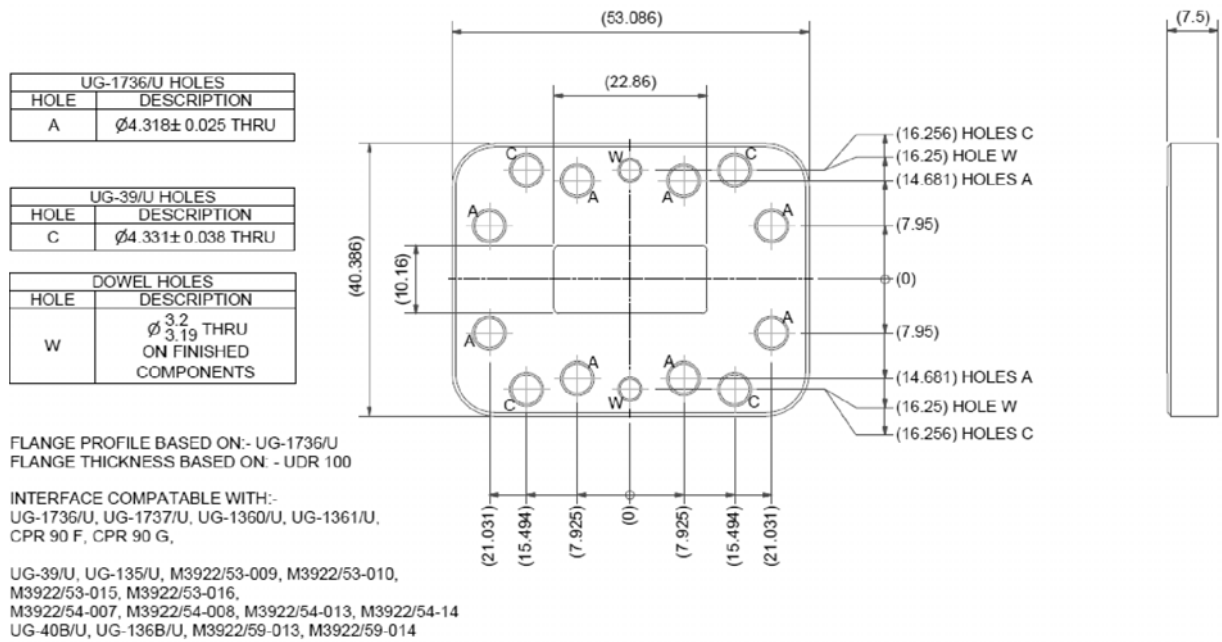
FLANGE PROFILE BASED ON:- UDR 100  
FLANGE THICKNESS BASED ON:- UDR 100

INTERFACE COMPATIBLE WITH:-  
UDR 100, RDR 100, PDR 100,  
UBR 100, PBR 100, CBR 100



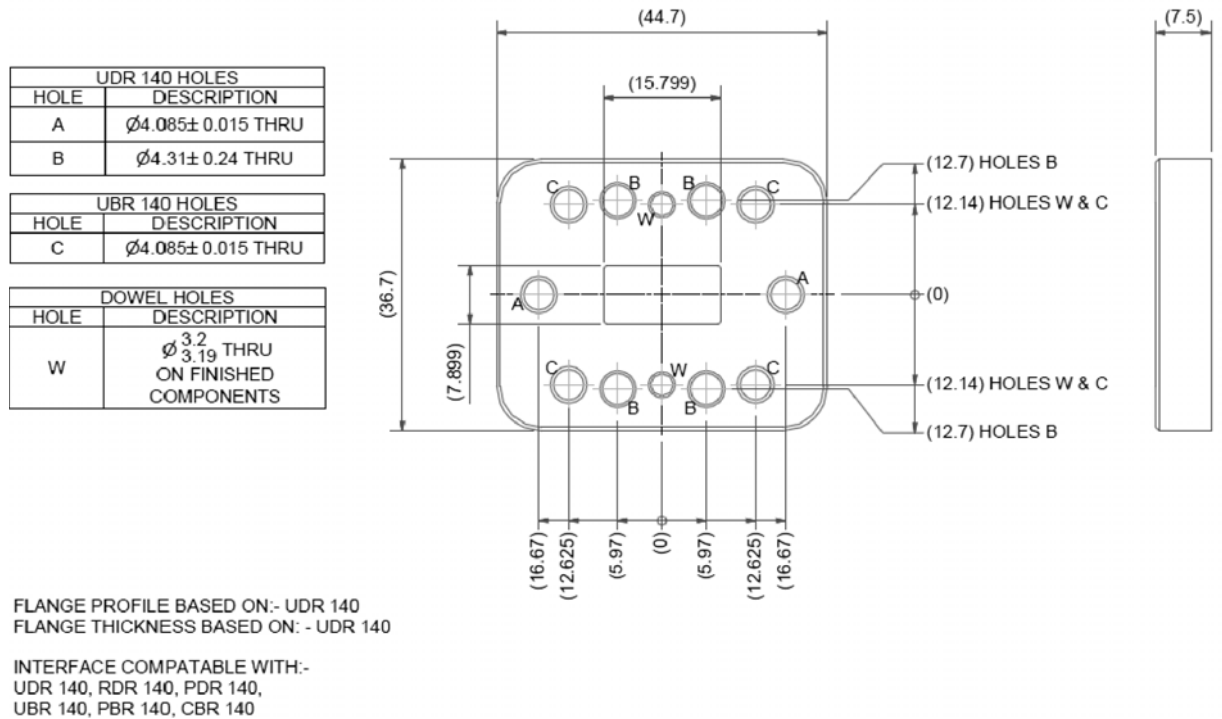
N9911\_002\_203

**Figure 5-4 Flange, Waveguide Designators X-Band/WR90/WG16, English (Imperial)**



N9911\_002\_204

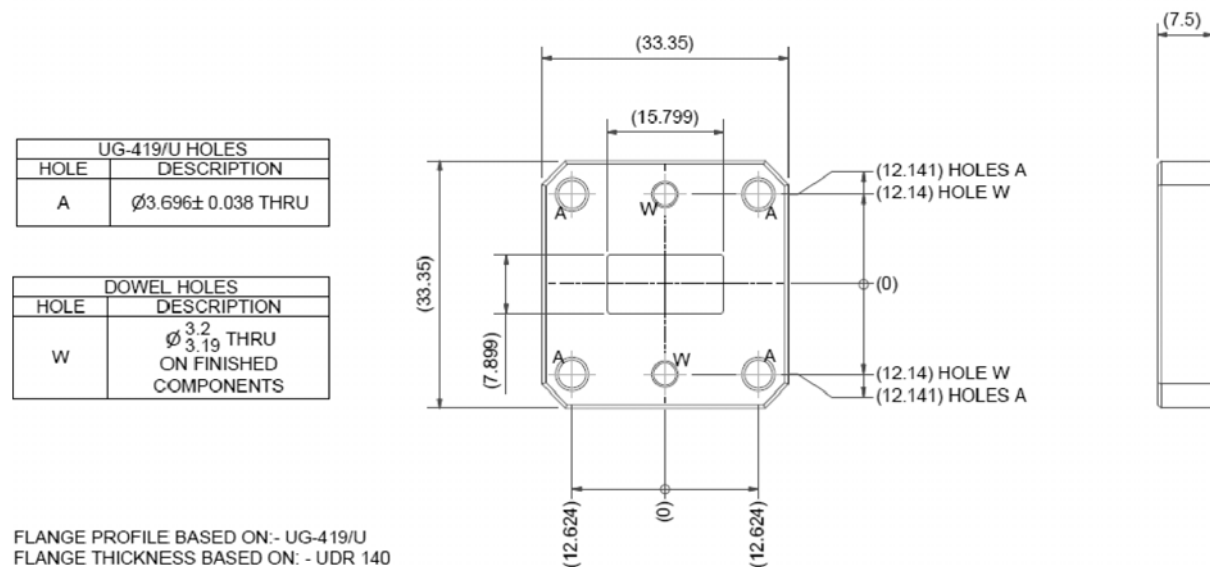
**Figure 5-5 Flange, Waveguide Designators Ku-Band/WR62/WG18, Metric**



N9911\_002\_205

## Flange Dimensions

### Figure 5-6 Flange, Waveguide Designators Ku-Band/WR62/WG18, English (Imperial)

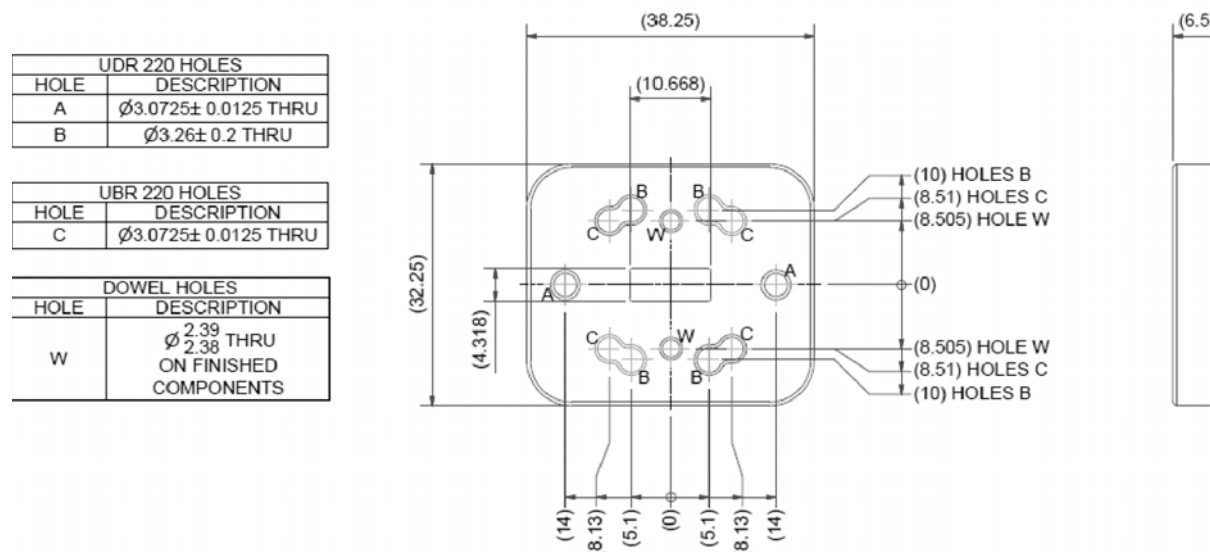


FLANGE PROFILE BASED ON:- UG-419/U  
FLANGE THICKNESS BASED ON:- UDR 140

INTERFACE COMPATABLE WITH:-  
UG-419/U, UG-1665/U,  
M3922/53-011, M3922/53-012, M3922/53-017, M3922/53-018,  
M3922/54-009, M3922/54-010,  
UG-5414/U, UG-1666/U,  
M3922/70-007, M3922/70-008, M3922/70-019, M3922/70-020,

N9911\_002\_206

**Figure 5-7 Flange, Waveguide Designators K-Band/WR42/WG20, Metric**

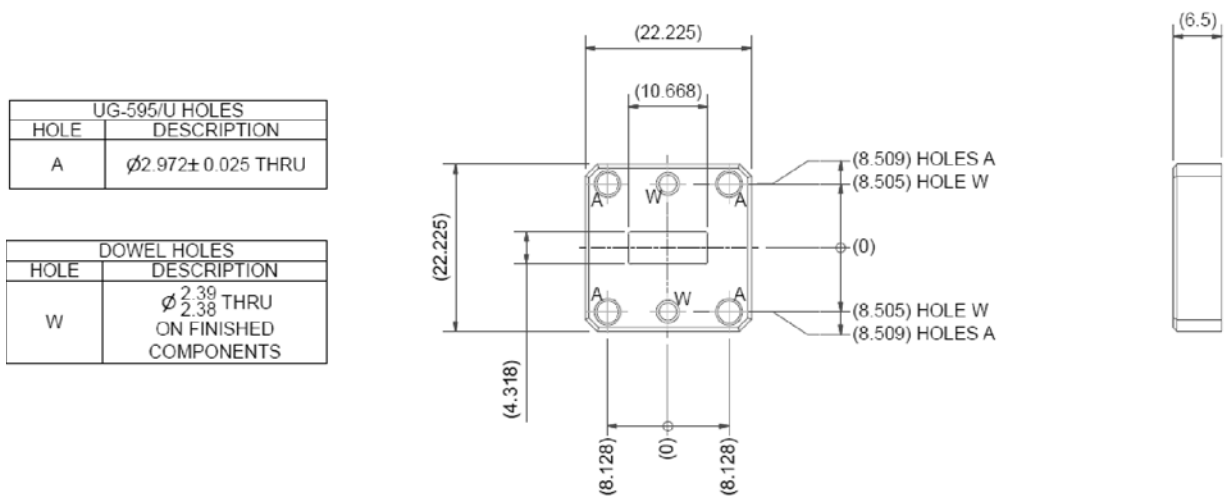


FLANGE PROFILE BASED ON:- UDR 220  
FLANGE THICKNESS BASED ON:- UDR 220

INTERFACE COMPATIBLE WITH:-  
UDR 220, RDR 220, PDR 220,  
UBR 220, PBR 220, CBR 220

N9911 002 207

**Figure 5-8 Flange, Waveguide Designators K-Band/WR42/WG20, English (Imperial)**



FLANGE PROFILE BASED ON:- UG-595/U  
FLANGE THICKNESS BASED ON:- UDR 220

INTERFACE COMPATIBLE WITH:-  
UG-595/U, UG-597/U,  
UG-596A/U, UG598A/U,  
M3922/70-027, M3922/70-028

N9911\_002\_208

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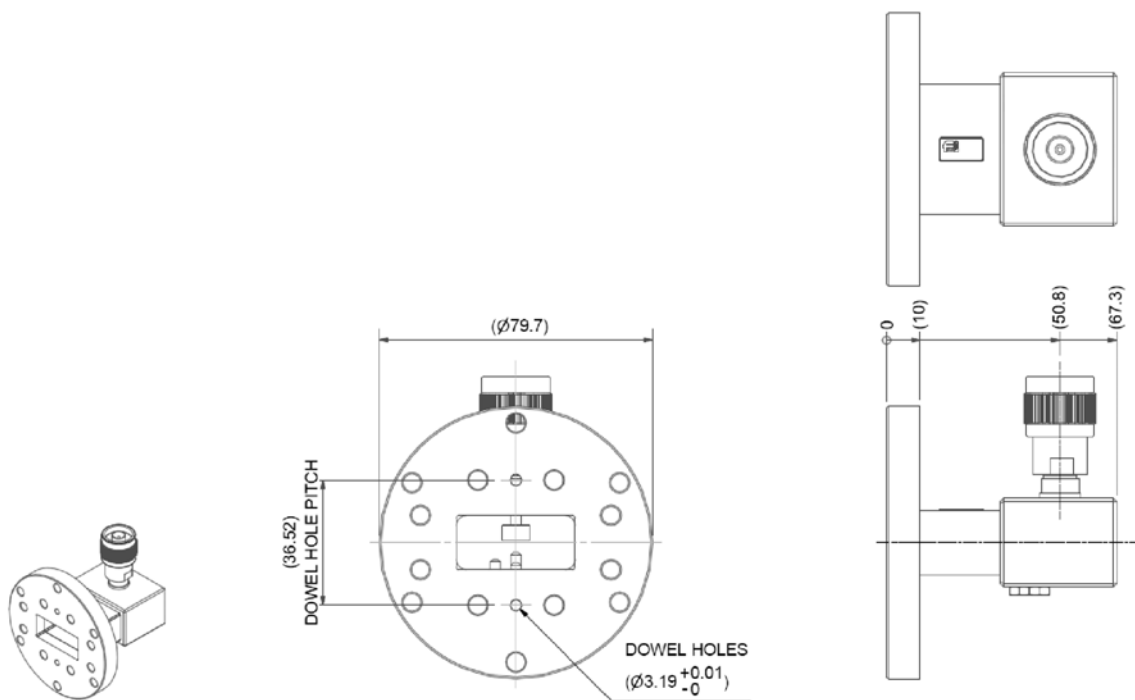
## Waveguide-to-Coax Adapter Dimensions

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**NOTE** The dimensions shown in the following graphics are in millimeters.

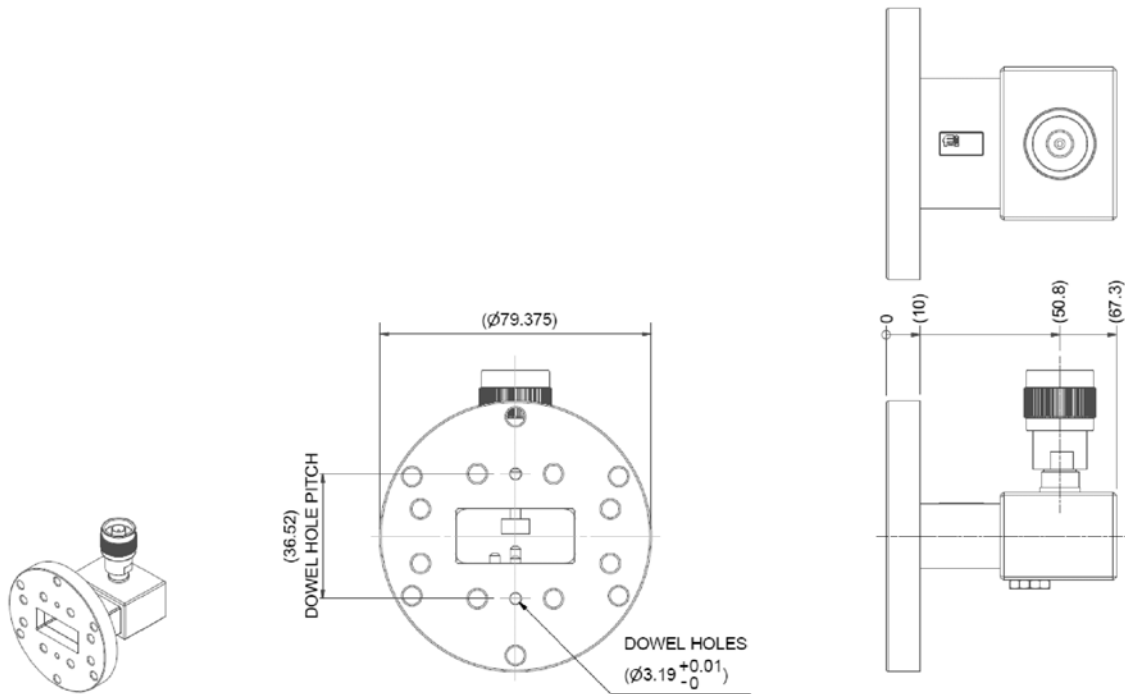
---

**Figure 5-9** Adapter, Waveguide Designators C-Band/WR137/WG14, Metric, Keysight Part Number N9911X-110



N9911\_002\_235

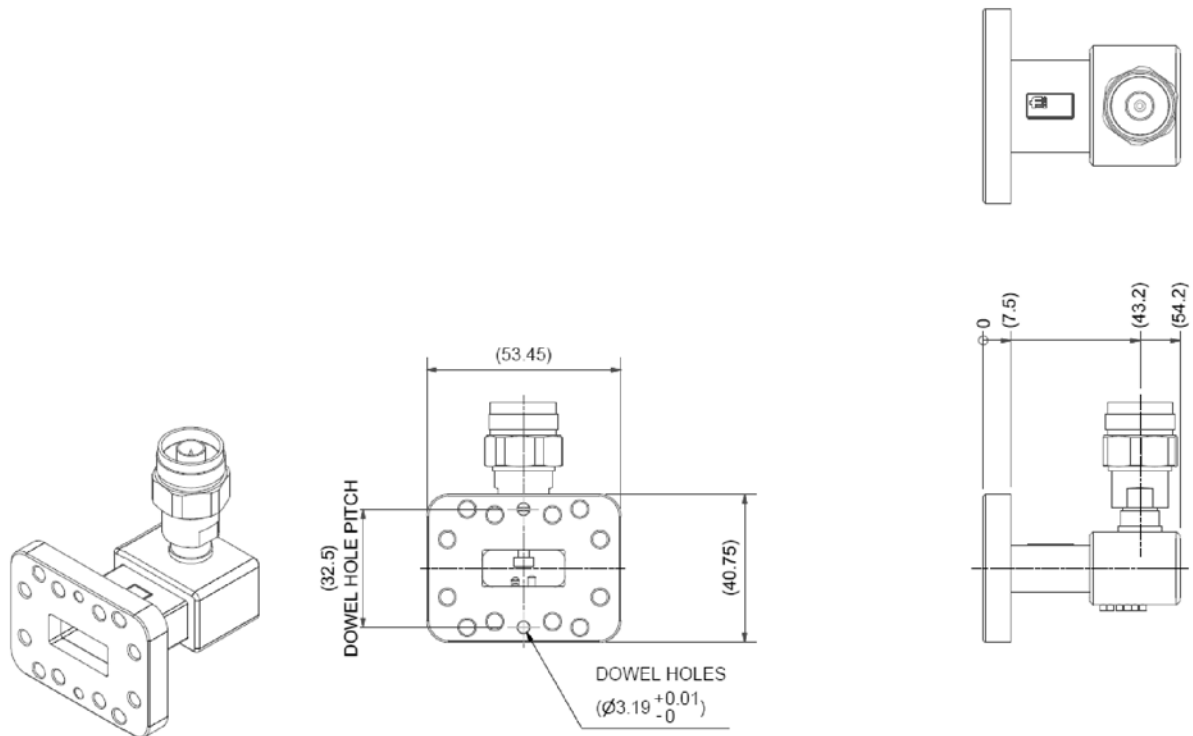
**Figure 5-10 Adapter, Waveguide Designators C-Band/WR137/WG14, English (Imperial), Keysight Part Number N9911X-115**



N9911\_002\_234

**Waveguide-to-Coax Adapter Dimensions**

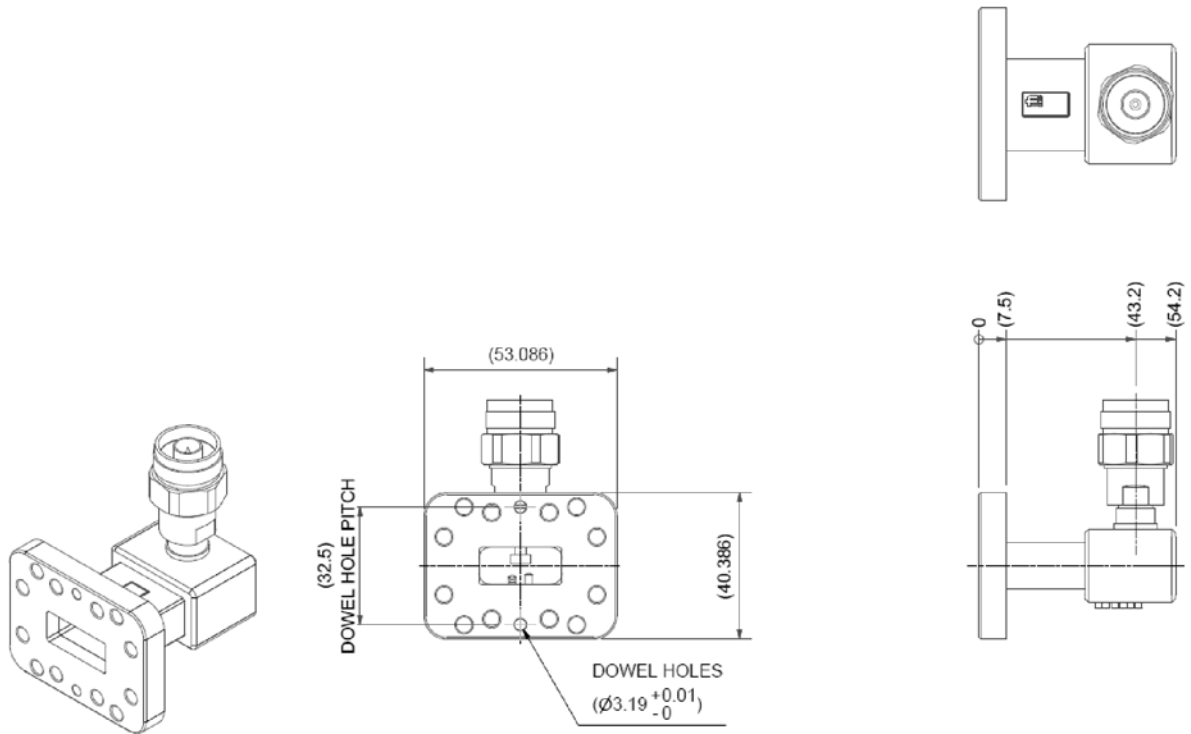
**Figure 5-11 Adapter, Waveguide Designators X-Band/WR90/WG16, Metric, Keysight Part Number N9911X-210**



N9911\_002\_214



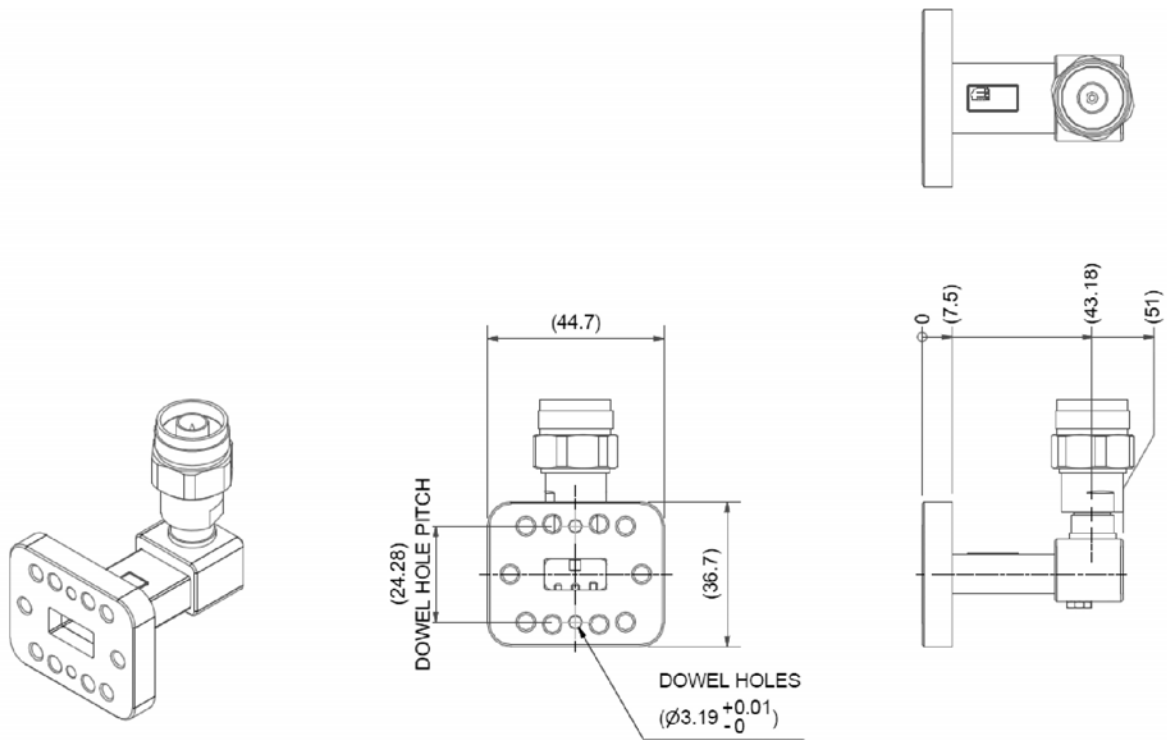
**Figure 5-12** Adapter, Waveguide Designators X-Band/WR90/WG16, English (Imperial), Keysight Part Number N9911X-215



N9911\_002\_213

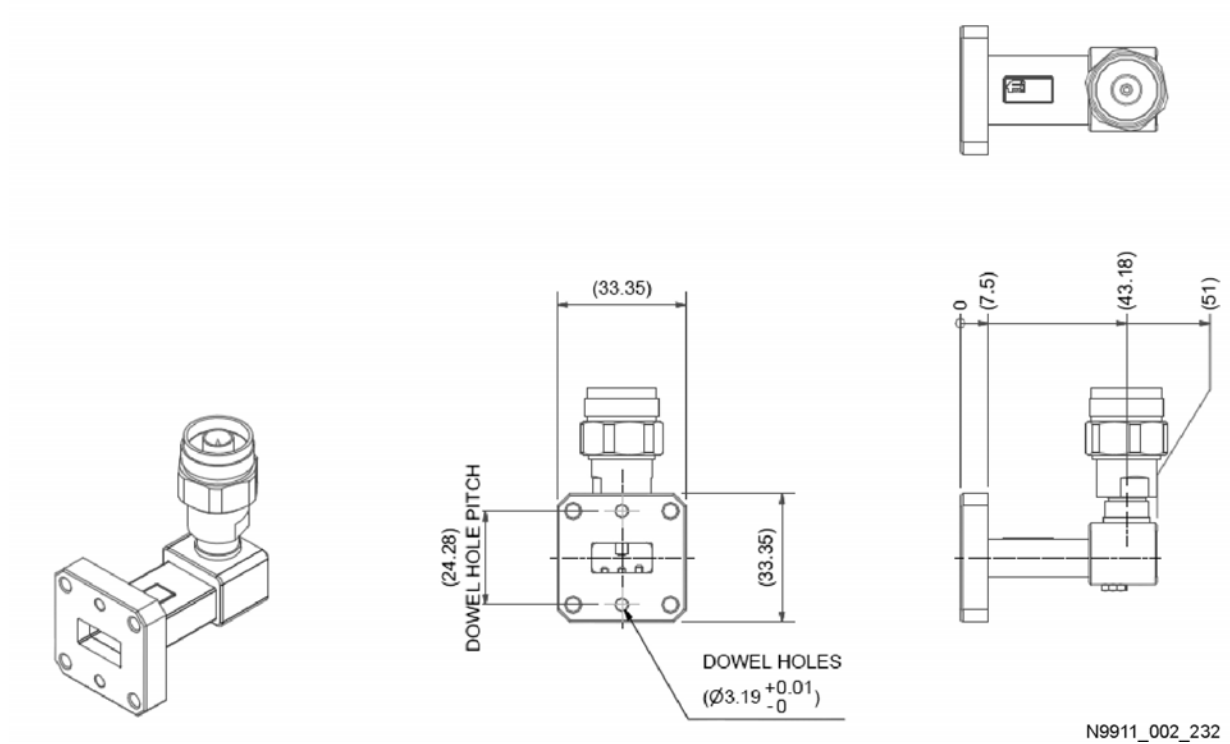
**Waveguide-to-Coax Adapter Dimensions**

**Figure 5-13 Adapter, Waveguide Designators Ku-Band/WR62/WG18, Metric, Keysight Part Number N9911X-310**



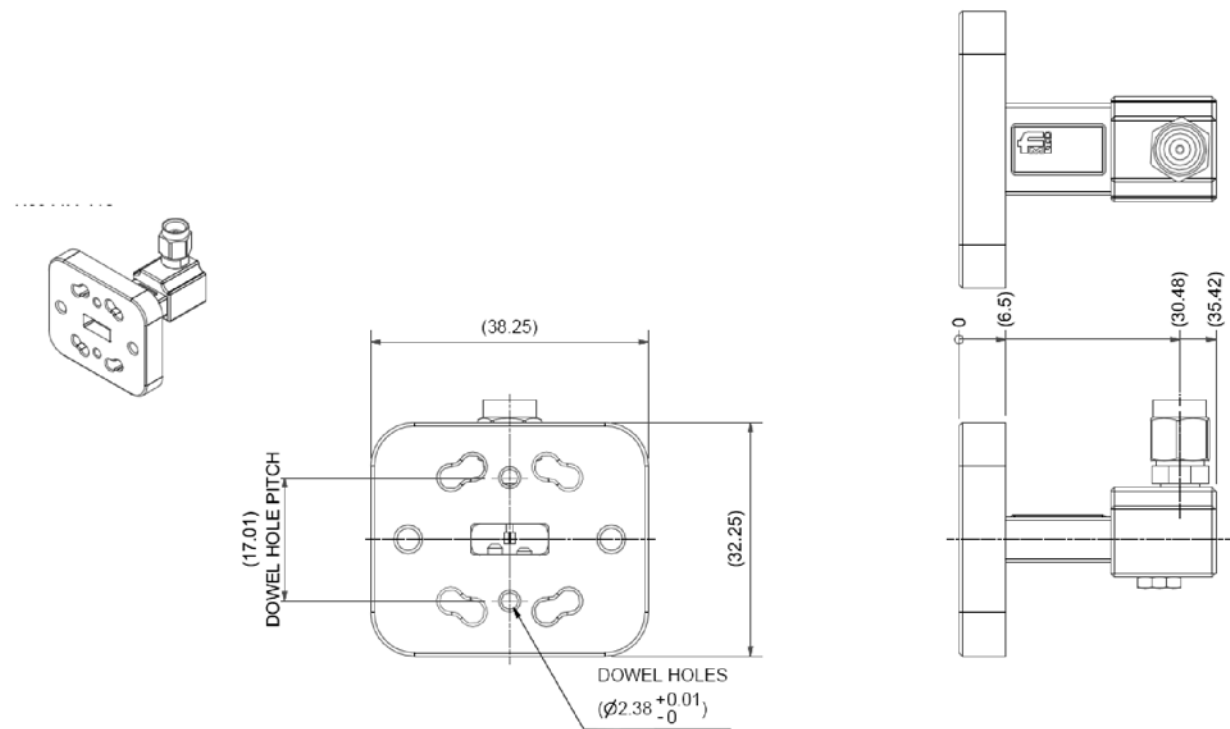
N9911\_002\_233

**Figure 5-14** Adapter, Waveguide Designators Ku-Band/WR62/WG18, English (Imperial), Keysight  
Part Number N9911X-315



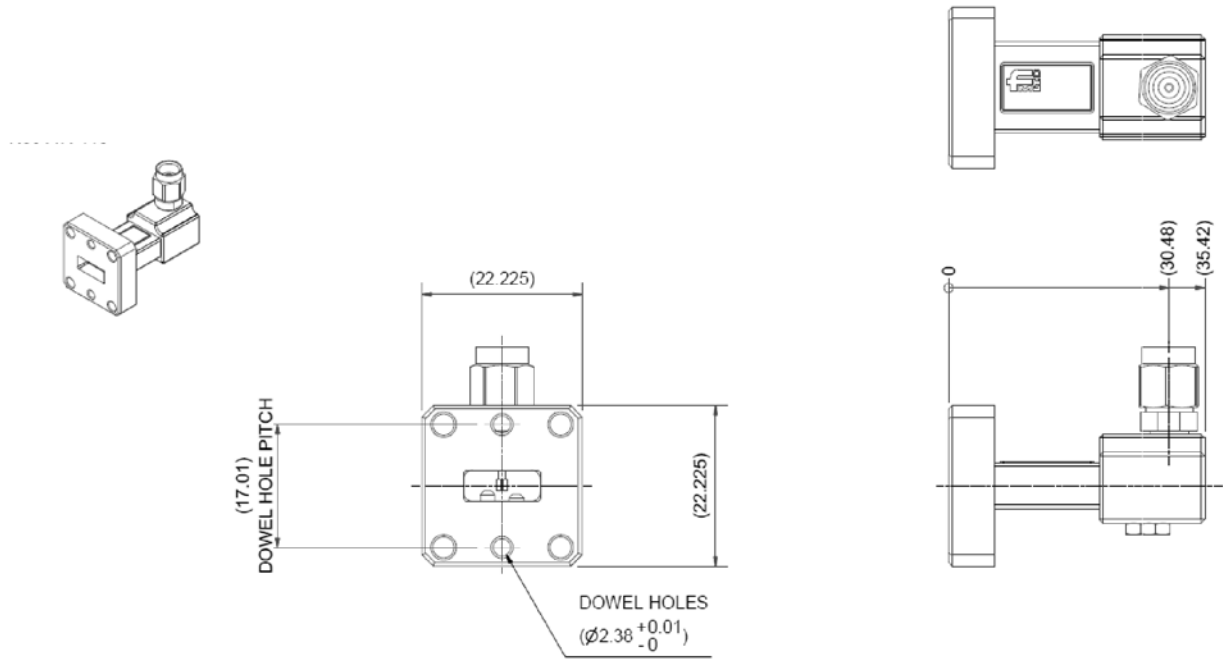
**Waveguide-to-Coax Adapter Dimensions**

**Figure 5-15 Adapter, Waveguide Designators K-Band/WR42/WG20, Metric, Keysight Part Number N9911X-410**



N9911\_002\_212

**Figure 5-16 Adapter, Waveguide Designators K-Band/WR42/WG20, English (Imperial), Keysight Part Number N9911X-415**

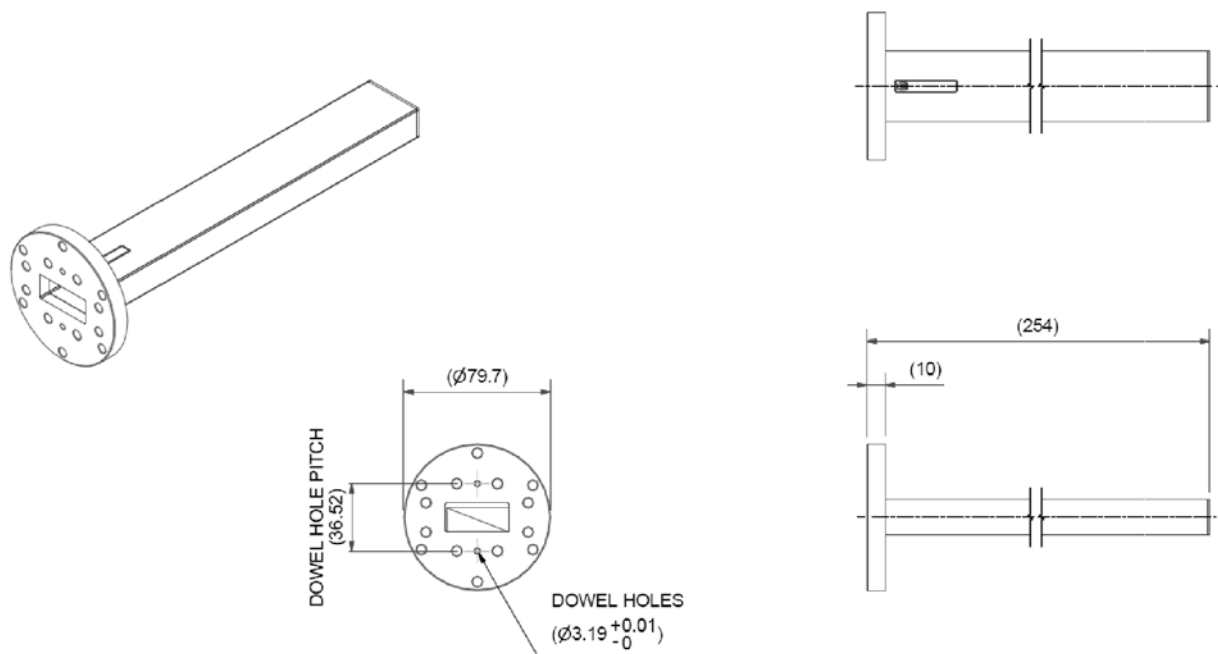


N9911\_002\_211

## Termination Dimensions

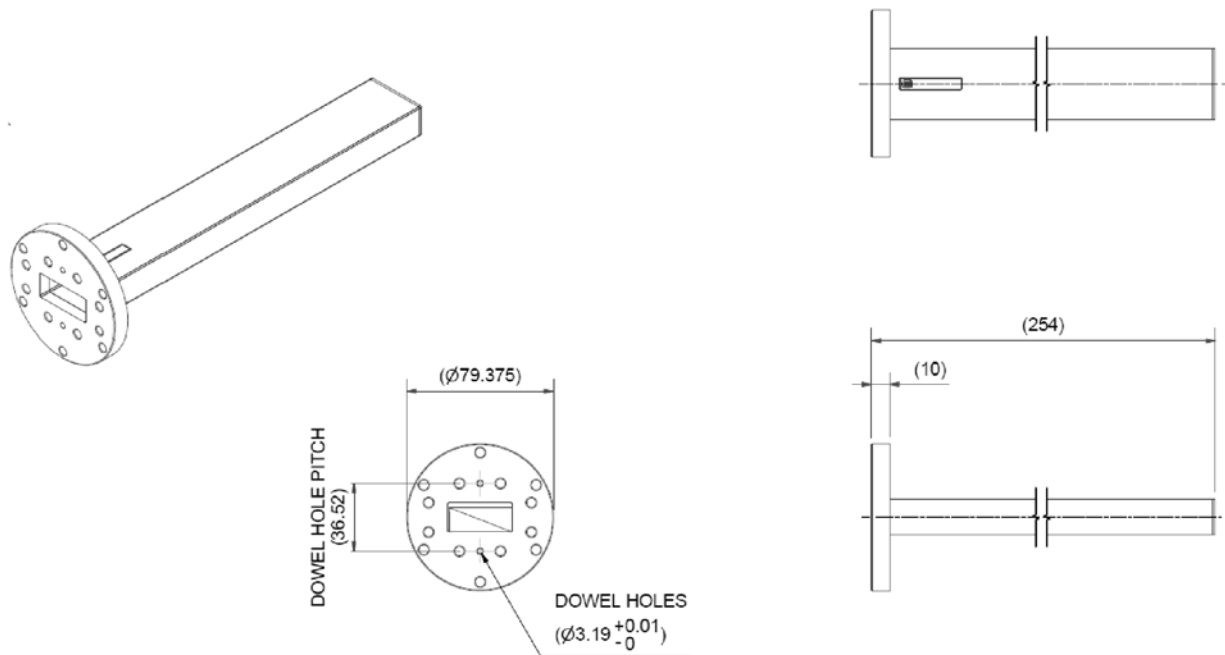
**NOTE** The dimensions shown in the following graphics are in millimeters.

**Figure 5-17 Termination, Waveguide Designators C-Band/WR137/WG14, Metric, Keysight Part Number N9911X-111**



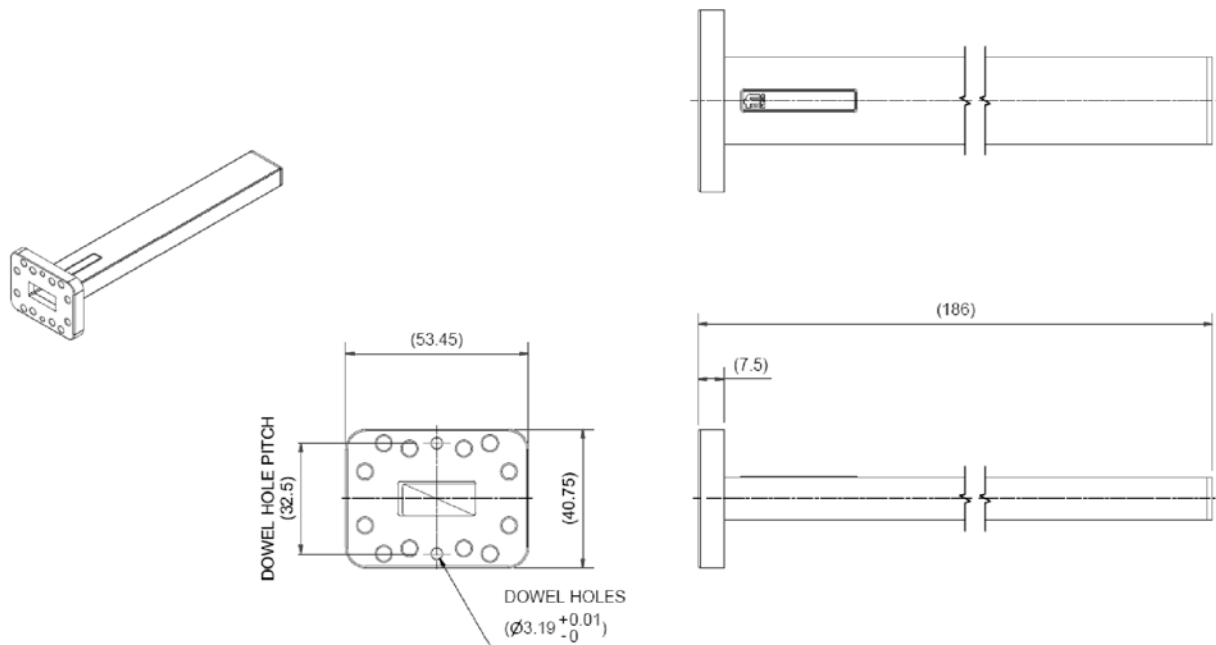
N9911\_002\_236

**Figure 5-18** Termination, Waveguide Designators C-Band/WR137/WG14, English (Imperial), Keysight Part Number N9911X-116



N9911\_002\_237

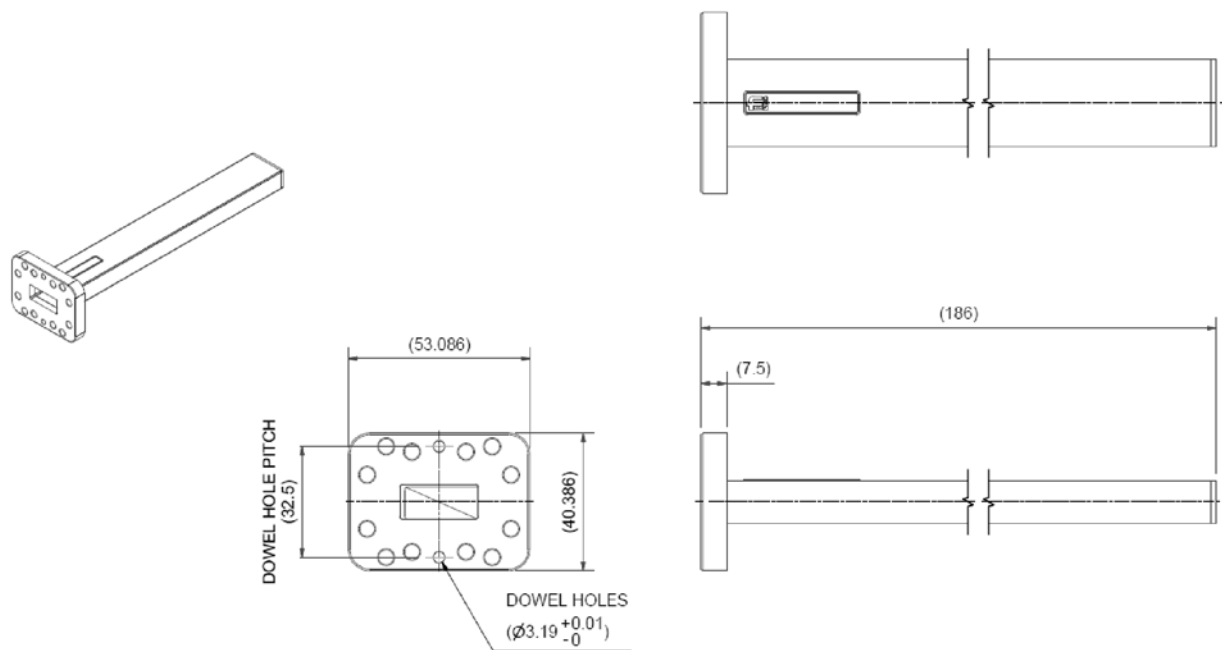
**Figure 5-19 Termination, Waveguide Designators X-Band/WR90/WG16, Metric, Keysight Part Number N9911X-211**



N9911\_002\_220

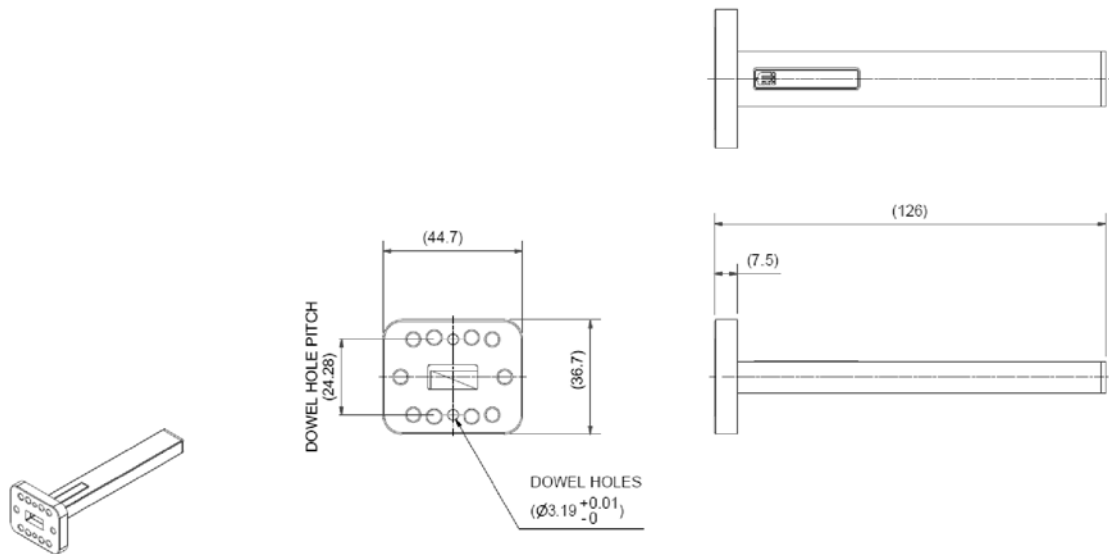


**Figure 5-20 Termination, Waveguide Designators X-Band/WR90/WG16, English (Imperial), Keysight Part Number N9911X-216**



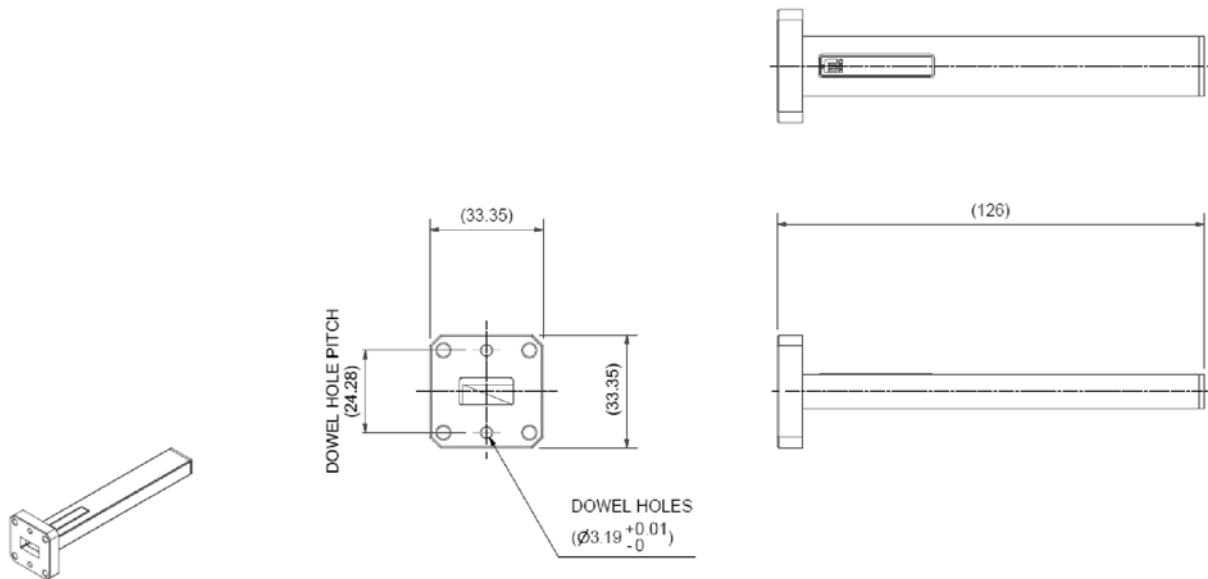
N9911\_002\_219

**Figure 5-21 Termination, Waveguide Designators Ku-Band/WR62/WG18, Metric, Keysight Part Number N9911X-311**



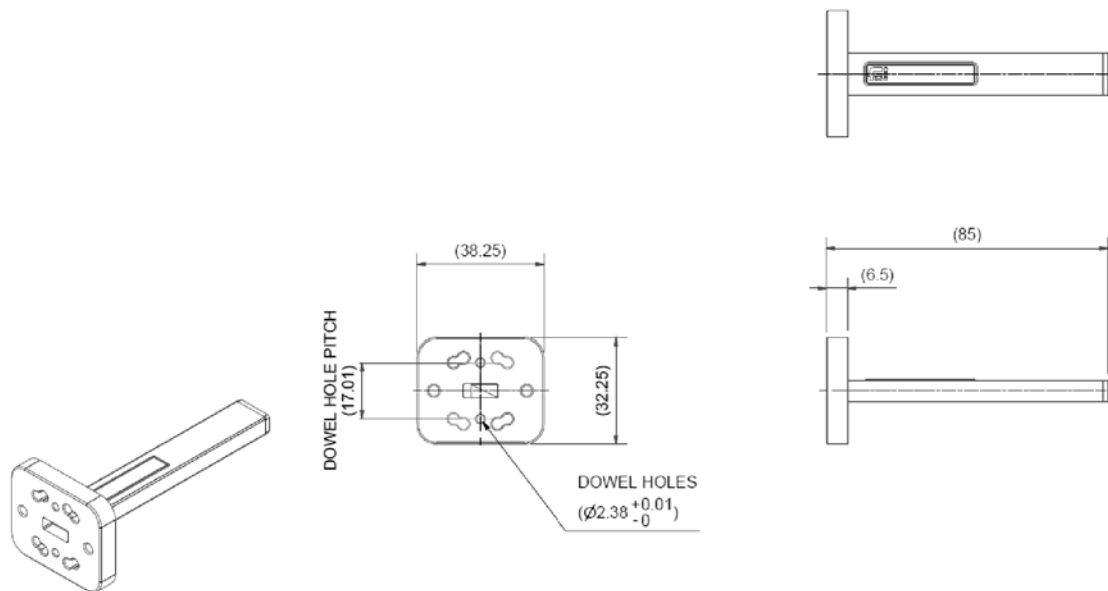
N9911\_002\_218

**Figure 5-22 Termination, Waveguide Designators Ku-Band/WR62/WG18, English (Imperial), Keysight Part Number N9911X-316**



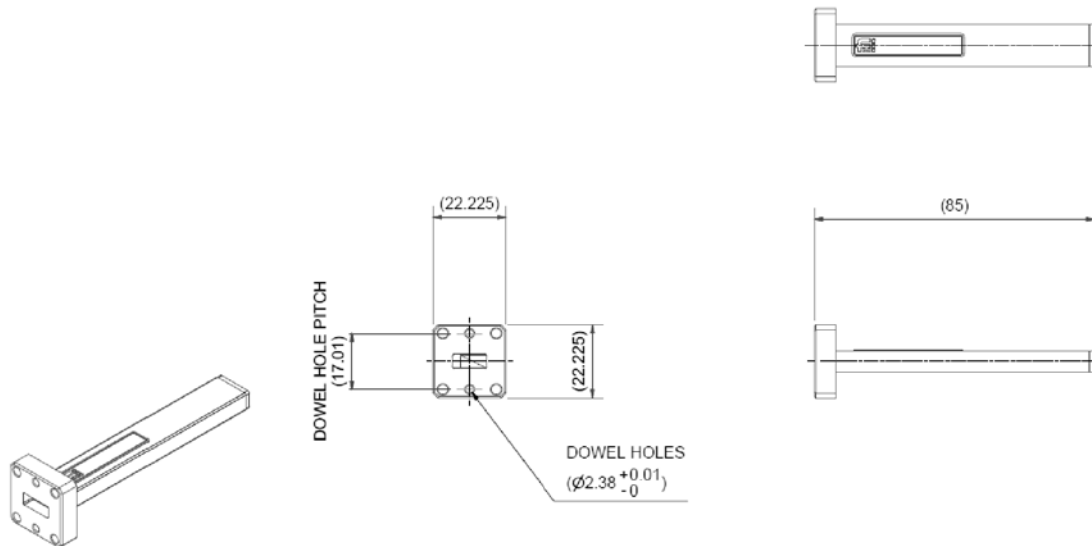
N9911\_002\_217

**Figure 5-23 Termination, Waveguide Designators K-Band/WR42/WG20, Metric, Keysight Part Number N9911X-411**



N9911\_002\_216

**Figure 5-24 Termination, Waveguide Designators K-Band/WR42/WG20, English (Imperial), Keysight Part Number N9911X-416**

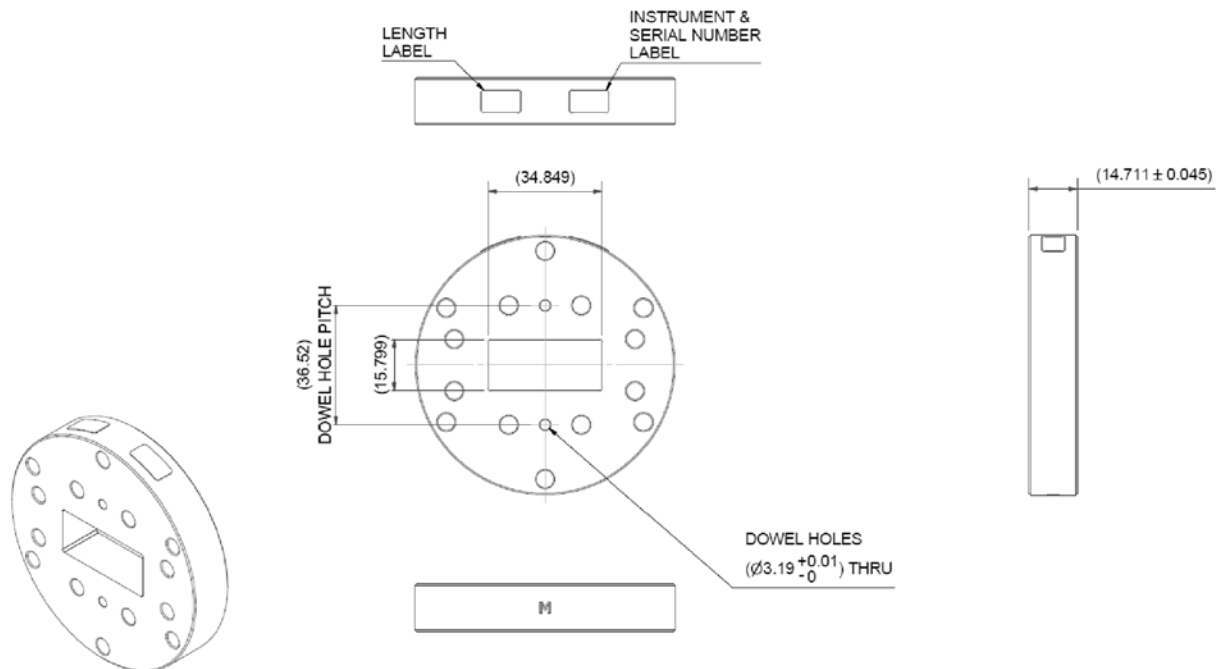


N9911\_002\_215

## Offset Shim Dimensions

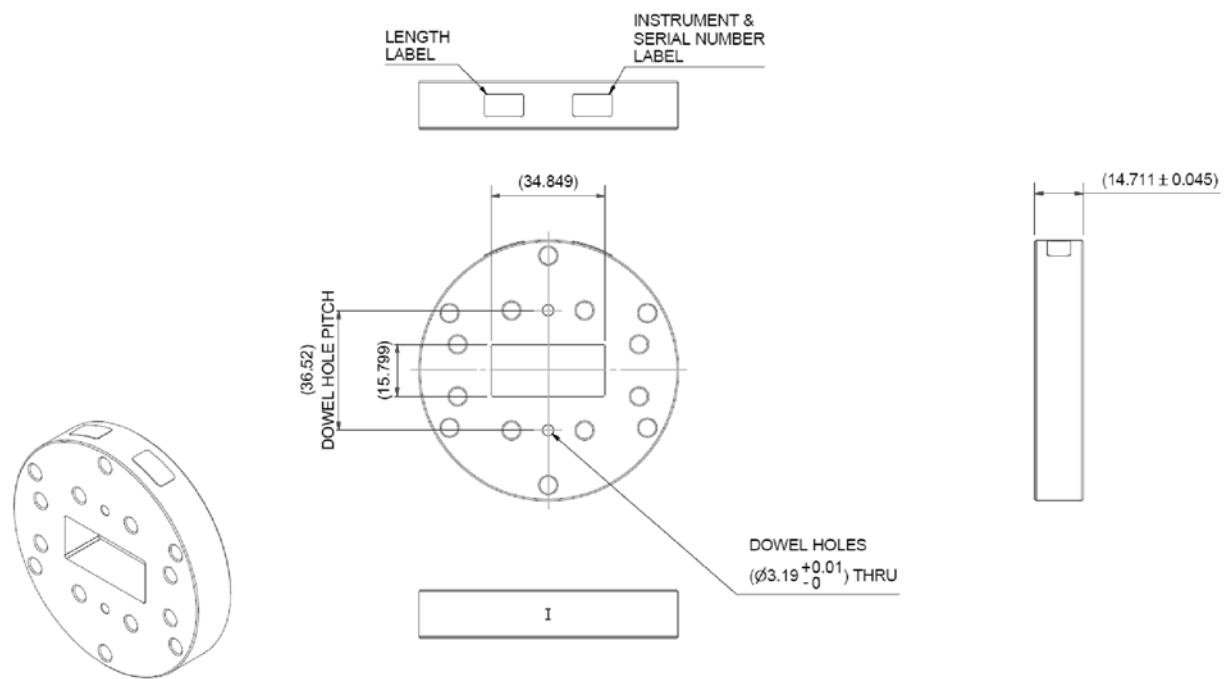
**NOTE** The dimensions shown in the following graphics are in millimeters.

**Figure 5-25** Offset Shim, Waveguide Designators C-Band/WR137/WG14, Metric, Keysight Part Number N9911X-113



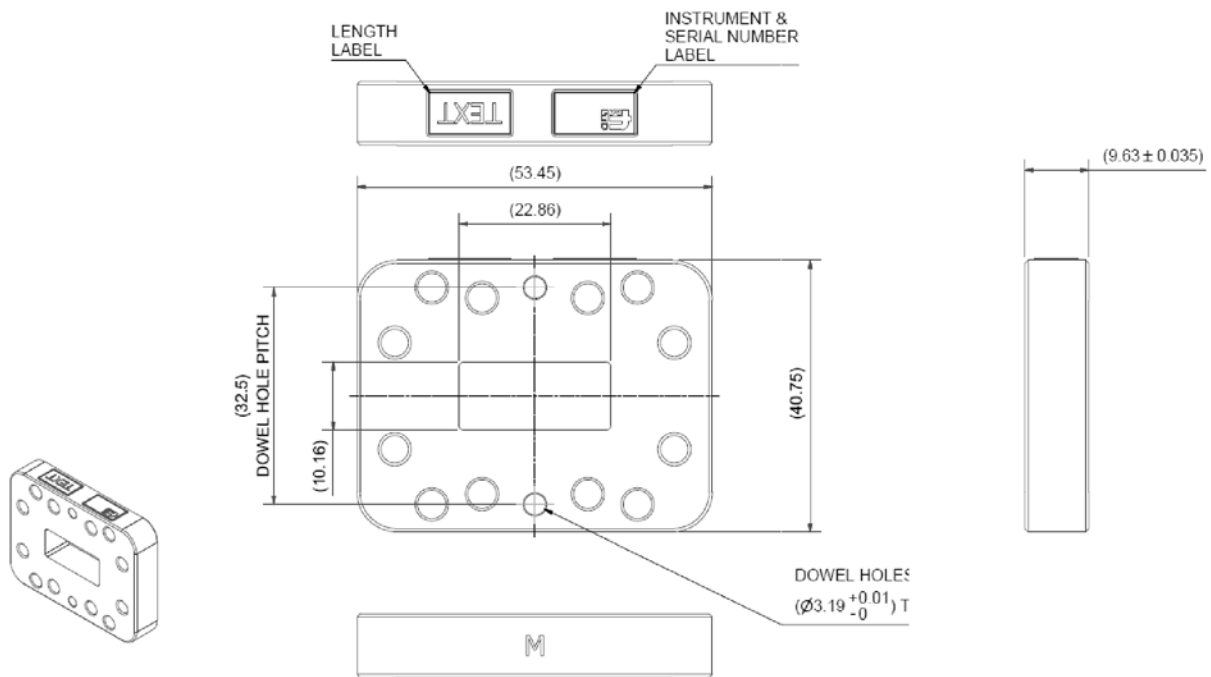
N9911\_002\_238

**Figure 5-26**    **Offset Shim, Waveguide Designators C-Band/WR137/WG14, English (Imperial), Keysight**  
**Part Number N9911X-118**



N9911\_002\_239

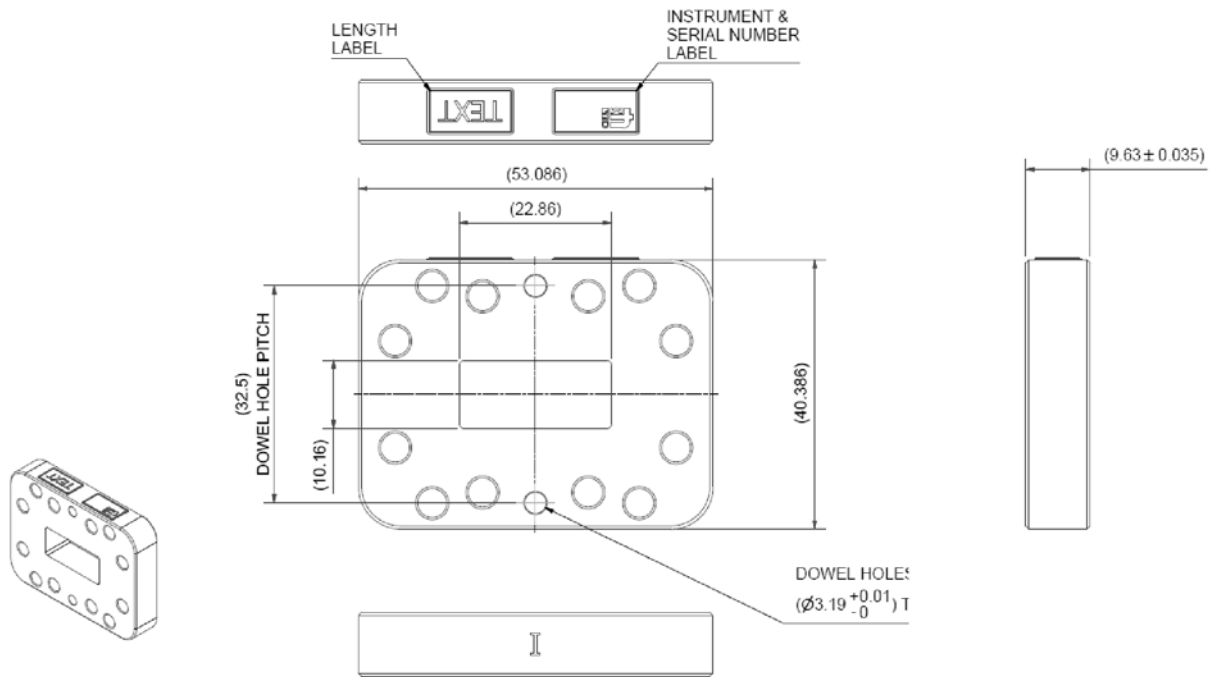
**Figure 5-27 Offset Shim, Waveguide Designators X-Band/WR90/WG16, Metric, Keysight Part Number N9911X-213**



N9911\_002\_225

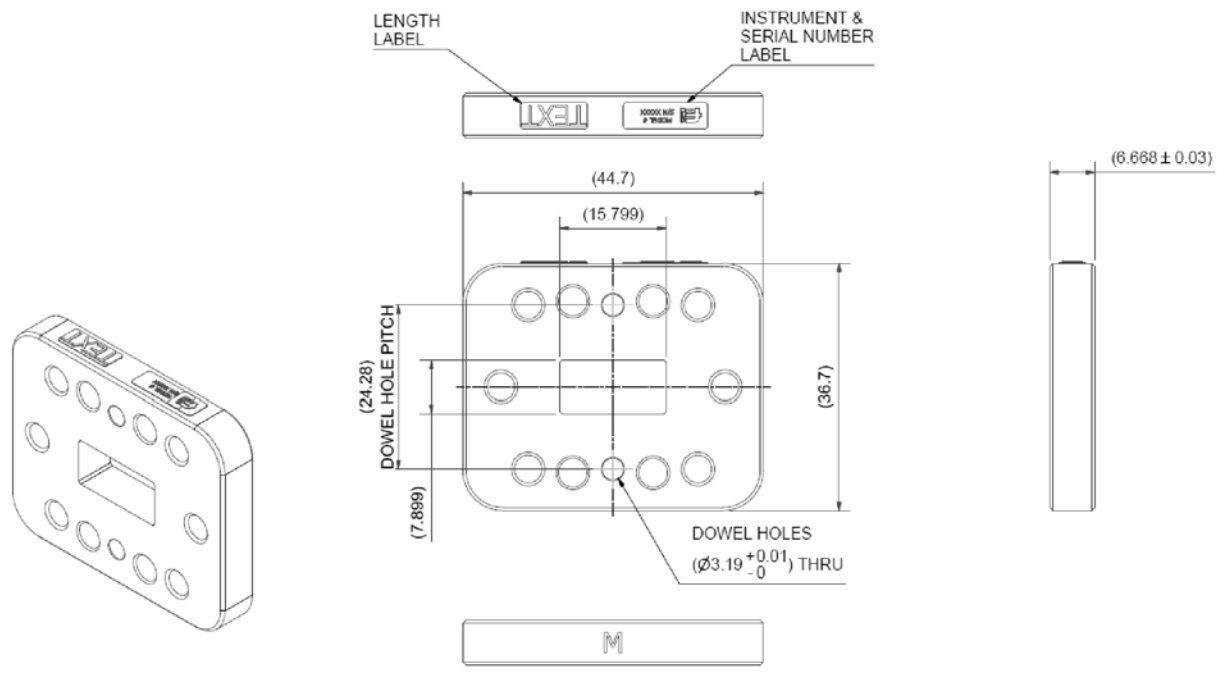


**Figure 5-28** Offset Shim, Waveguide Designators X-Band/WR90/WG16, English (Imperial), Keysight Part Number N9911X-218



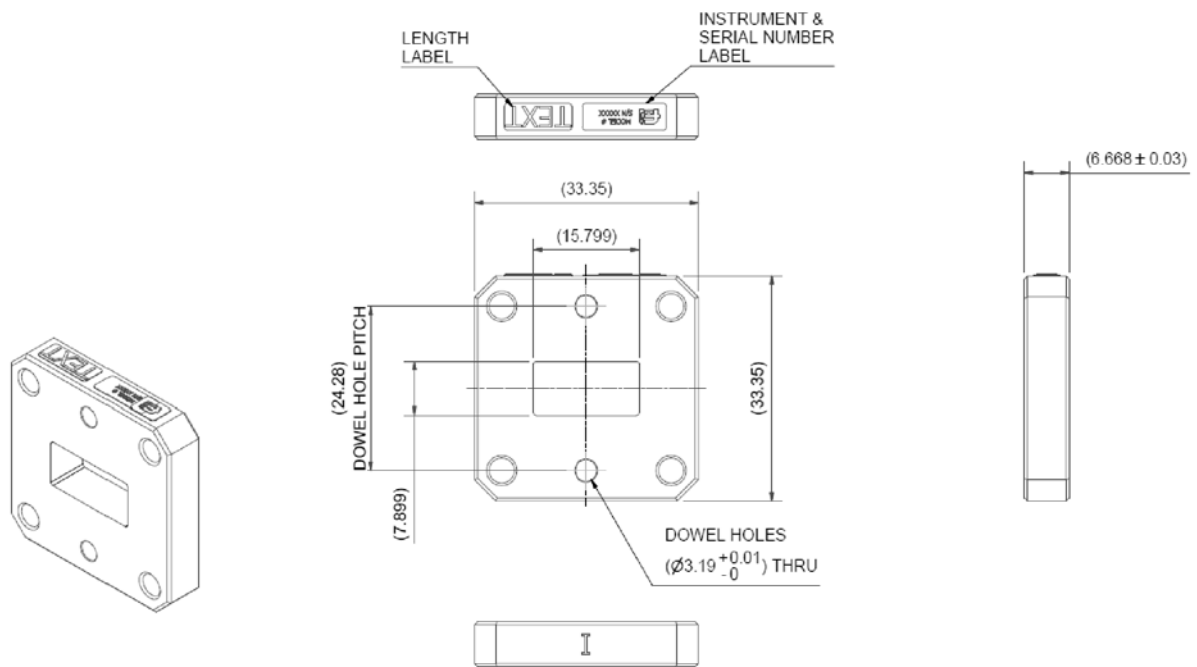
N9911\_002\_224

**Figure 5-29 Offset Shim, Waveguide Designators Ku-Band/WR62/WG18, Metric, Keysight Part Number N9911X-313**



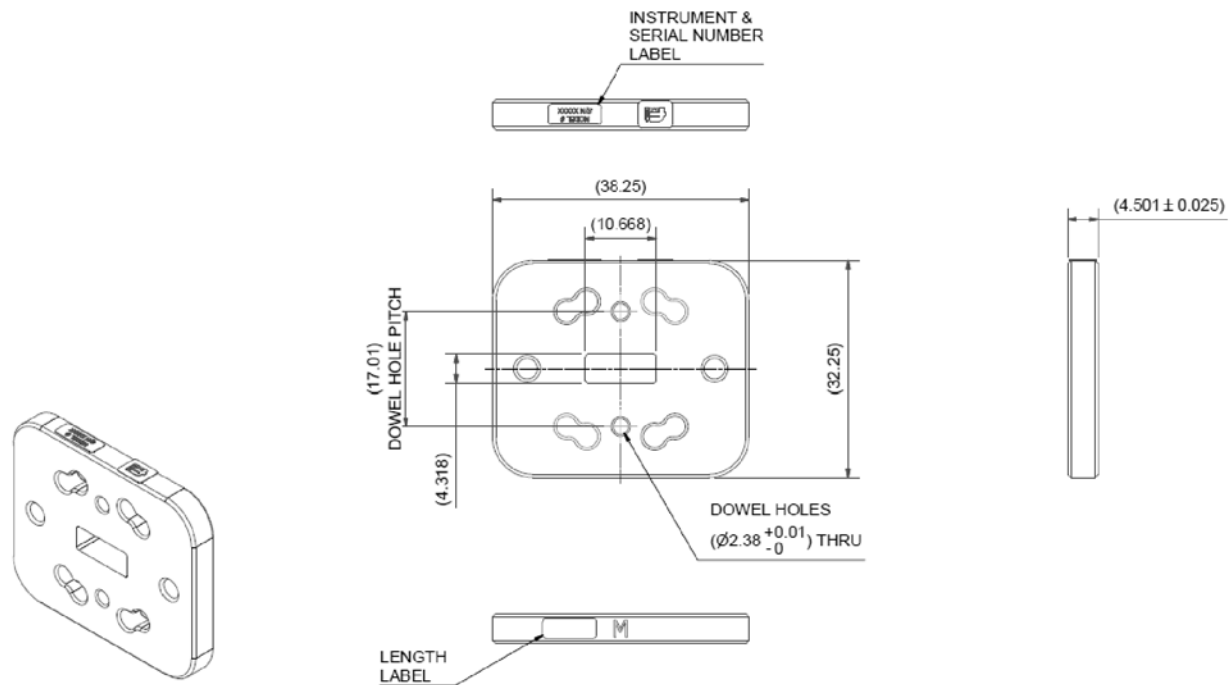
N9911\_002\_223

**Figure 5-30** Offset Shim, Waveguide Designators Ku-Band/WR62/WG18, English (Imperial), Keysight Part Number N9911X-318



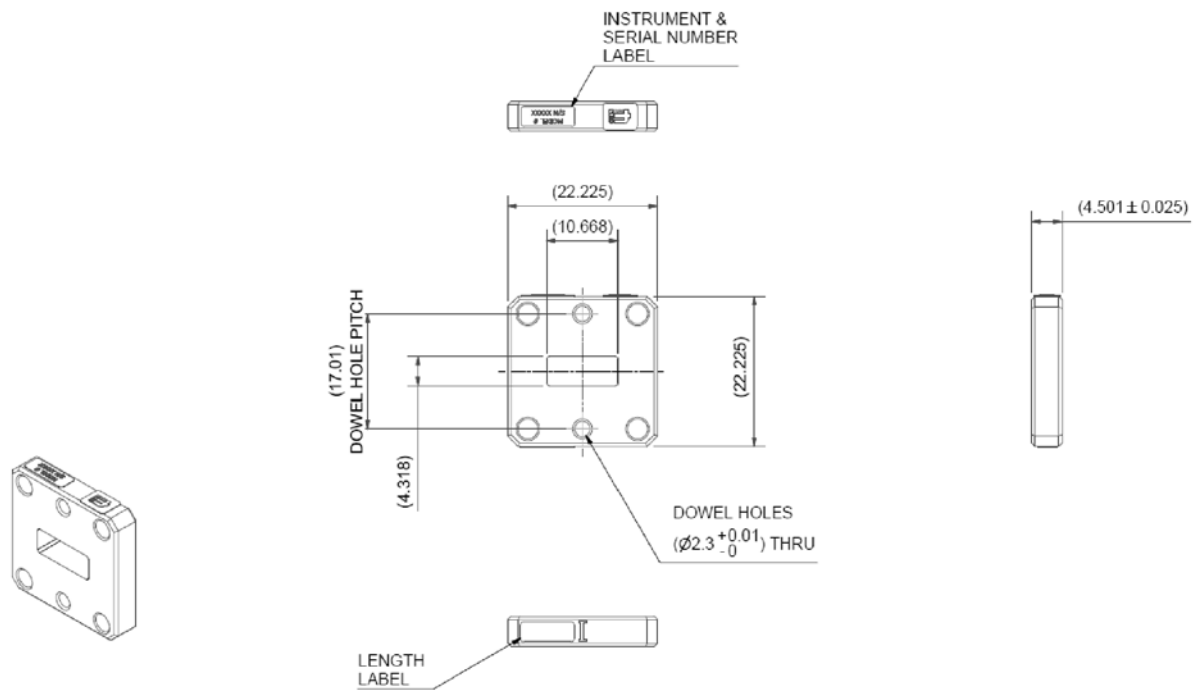
N9911\_002\_222

**Figure 5-31 Offset Shim, Waveguide Designators K-Band/WR42/WG20, Metric, Keysight Part Number N9911X-413**



N9911\_002\_210

**Figure 5-32** Offset Shim, Waveguide Designators K-Band/WR42/WG20, English (Imperial), Keysight Part Number N9911X-418

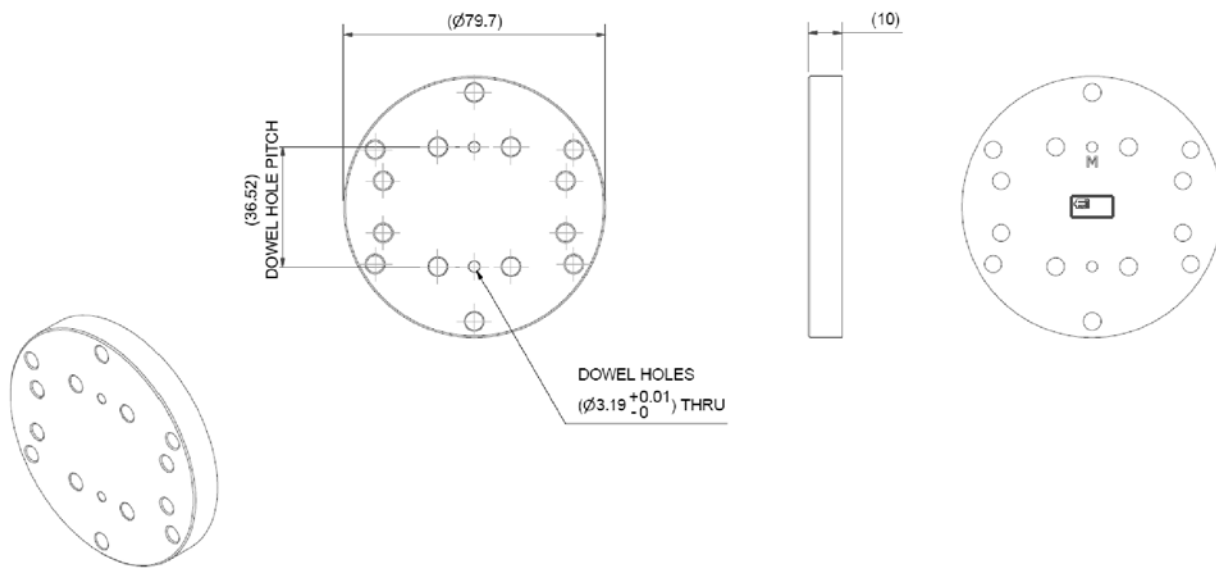


N9911\_002\_221

## Flush Short Dimensions

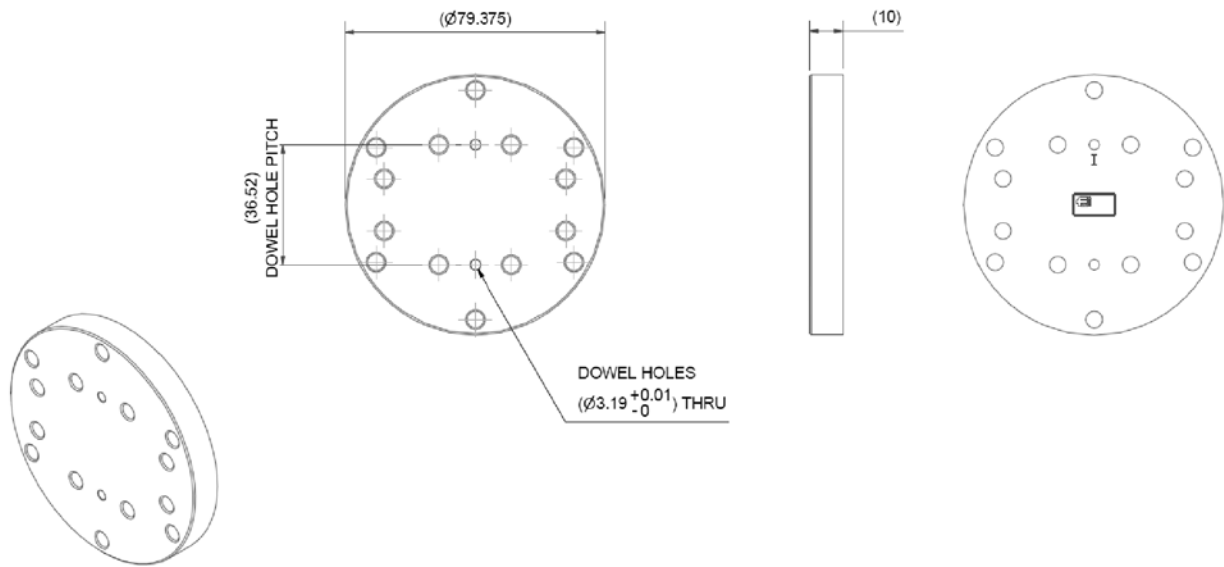
**NOTE** The dimensions shown in the following graphics are in millimeters.

**Figure 5-33** Flush Short, Waveguide Designators C-Band/WR137/WG14, Metric, Keysight Part Number N9911X-112



N9911\_002\_240

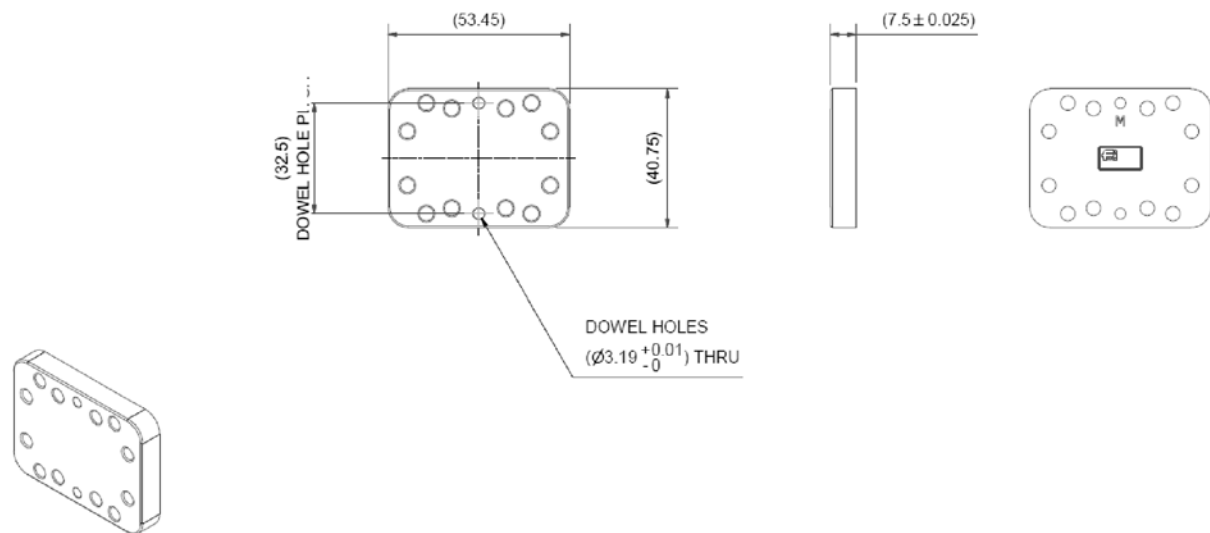
**Figure 5-34** Flush Short, Waveguide Designators C-Band/WR137/WG14, English (Imperial), Keysight Part Number N9911X-117



N9911\_002\_241

Component Dimensions  
**Flush Short Dimensions**

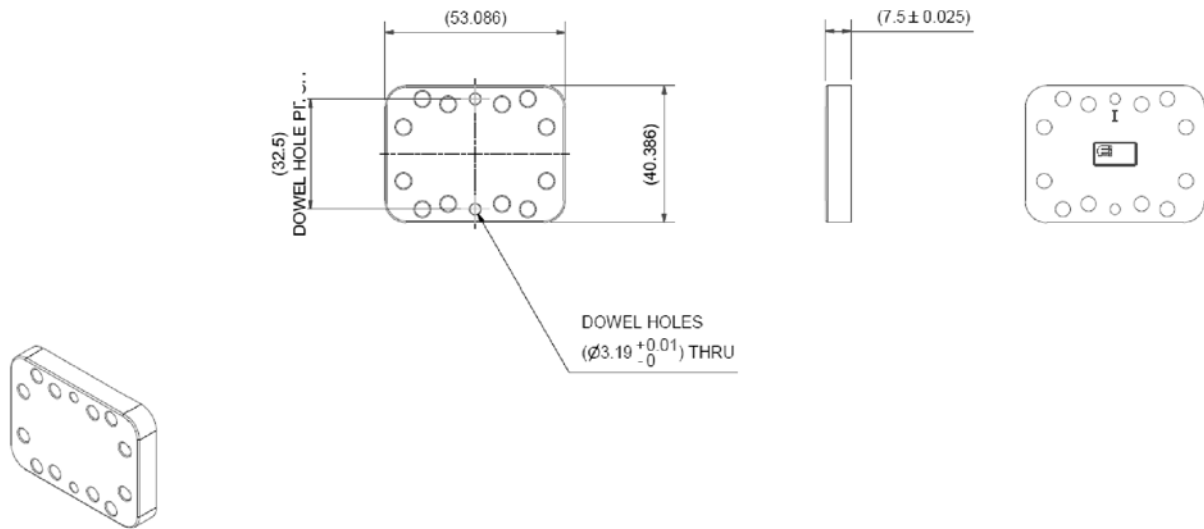
**Figure 5-35 Flush Short, Waveguide Designators X-Band/WR90/WG16, Metric, Keysight Part Number N9911X-212**



N9911\_002\_231

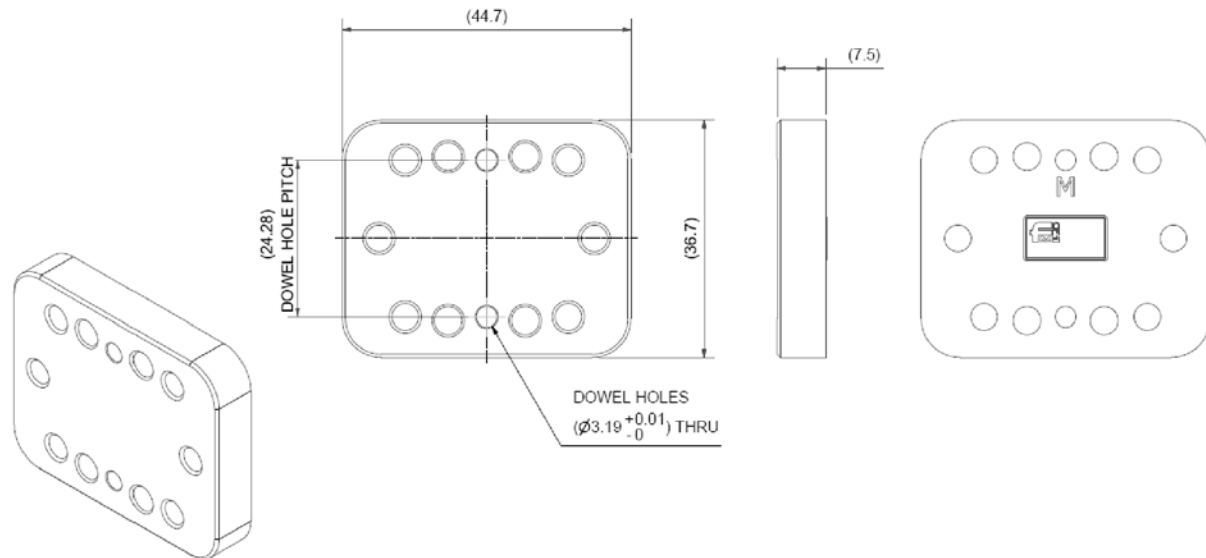


**Figure 5-36** Flush Short, Waveguide Designators X-Band/WR90/WG16, English (Imperial), Keysight Part Number N9911X-217



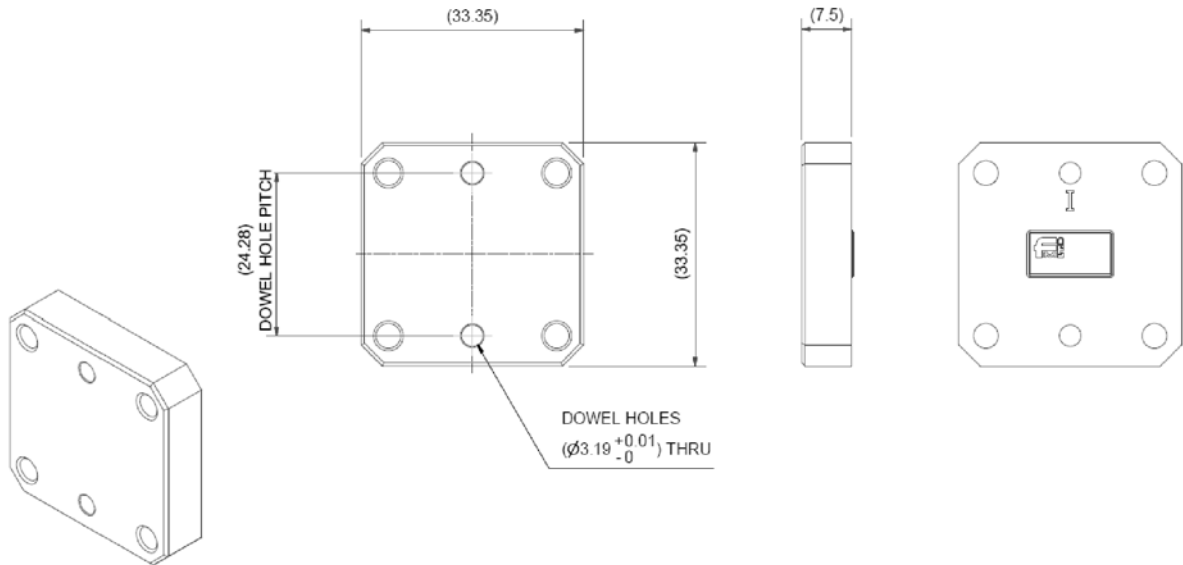
N9911\_002\_230

**Figure 5-37 Flush Short, Waveguide Designators Ku-Band/WR62/WG18, Metric, Keysight Part Number N9911X-312**



N9911\_002\_229

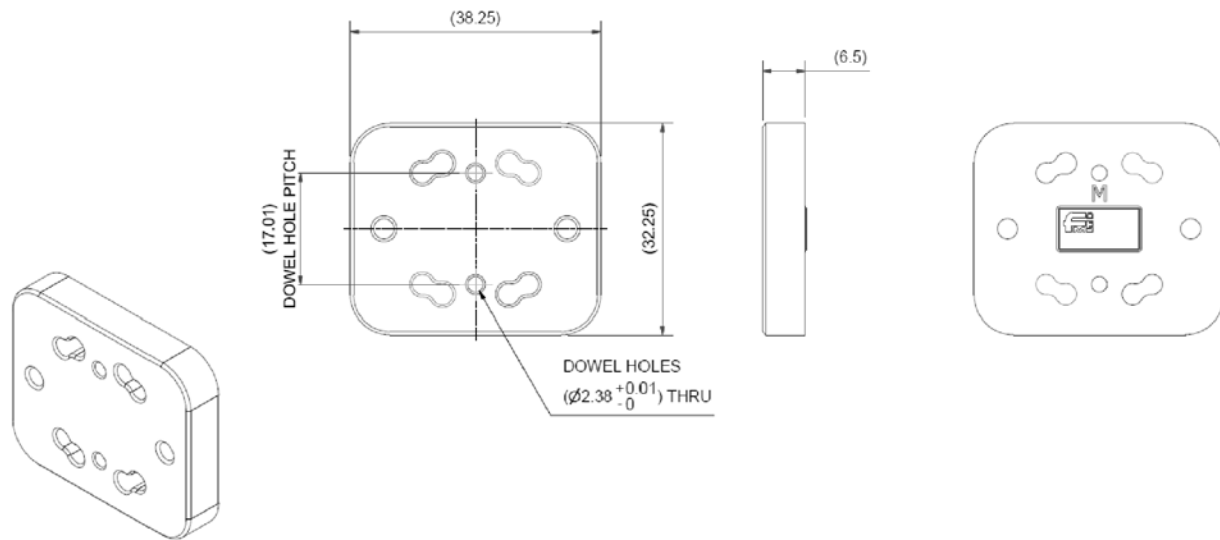
**Figure 5-38** Flush Short, Waveguide Designators Ku-Band/WR62/WG18, English (Imperial), Keysight Part Number N9911X-317



N9911\_002\_228

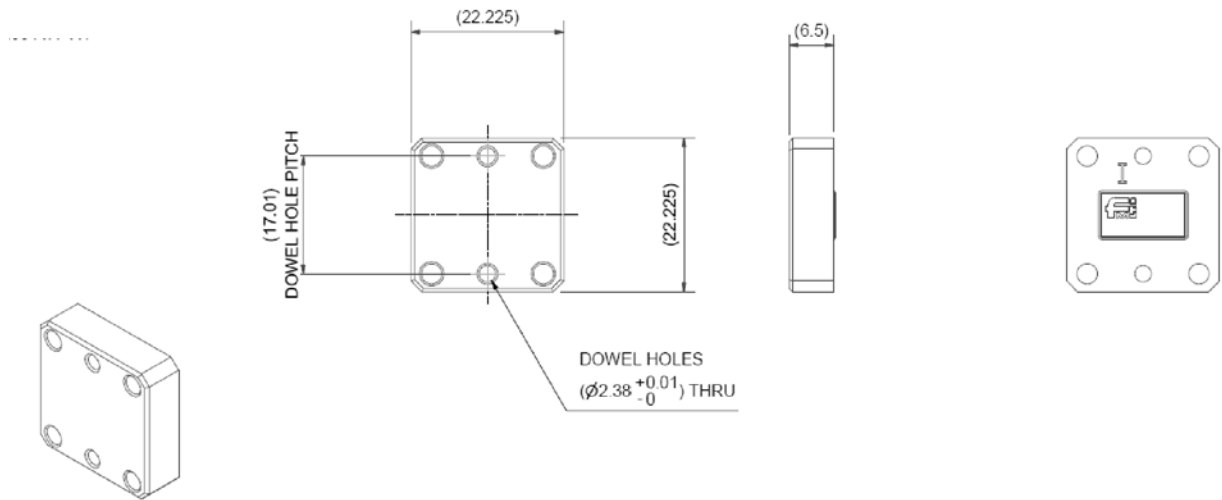
Component Dimensions  
**Flush Short Dimensions**

**Figure 5-39 Flush Short, Waveguide Designators K-Band/WR42/WG20, Metric, Keysight Part Number N9911X-412**



N9911\_002\_227

**Figure 5-40** Flush Short, Waveguide Designators K-Band/WR42/WG20, English (Imperial), Keysight Part Number N9911X-417



N9911\_002\_226

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