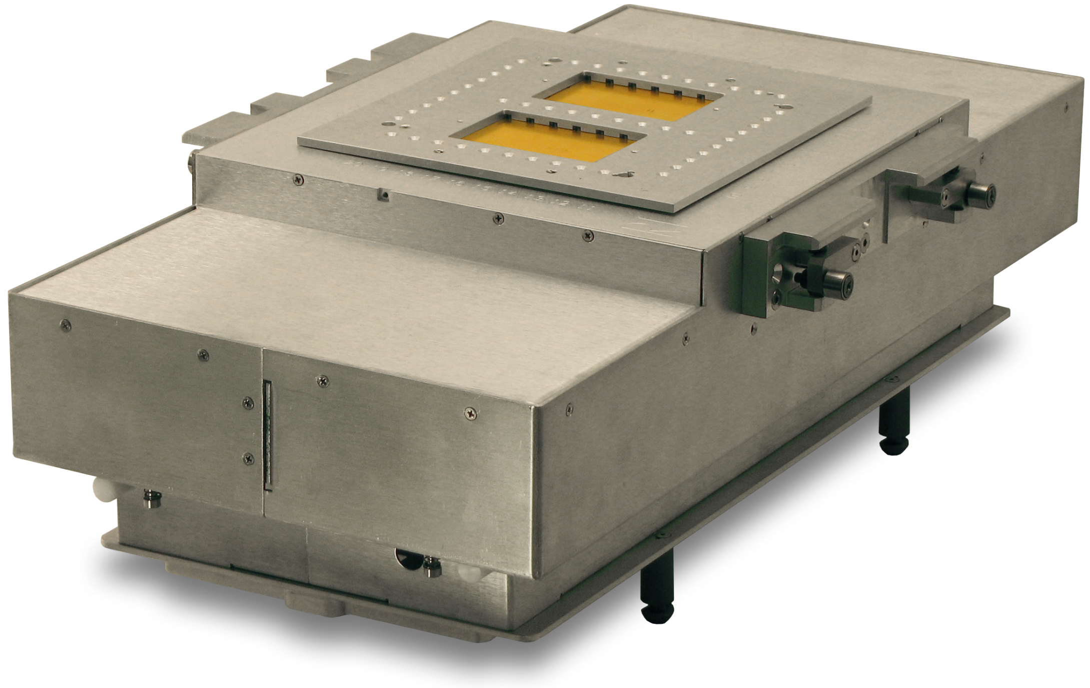
DEVICE INTERFACE DESIGN GUIDE

for Cassini ATE Systems



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INTRODUCTION

1

The Introduction Chapter provides general fixture information such as:

- **Component Descriptions**
- **Docking & Undocking**

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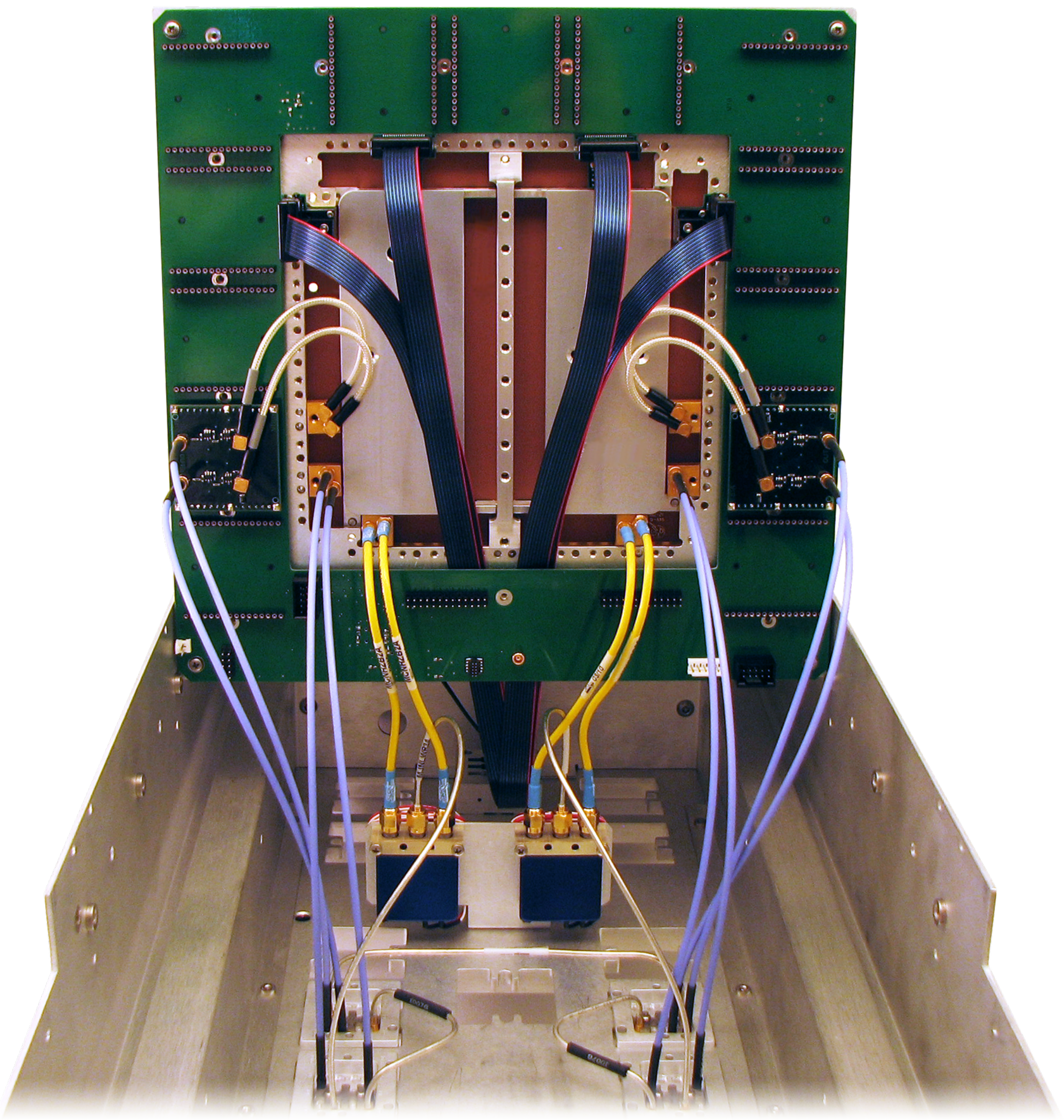
FIXTURES



OVERVIEW

Cassini fixtures carry the modular architecture of Cassini into the device interface environment. Housed in a rugged aluminum enclosure is a completely configurable test resource environment. The form factor and discrete design layers support an application range from DC to 90GHz. Integration with Cassini's software allow fixtures to extend and enhance the capabilities of test instruments with an integrated calibration layer that delivers signal accuracy right to the device pin.

COMPONENTS

The functionality and capability of traditional load boards have been reengineered to take advantage of the configurable instrument framework of Cassini. The discrete layers shown in Figure 1.1, enable design and development flexibility for high-performance RF devices that can be optimized independently to suit application needs. Listed below are the component names and definitions:

1. **Device Interface Board (DIB) Clamp** - one of three components comprising the Quick-Lock™ system, the DIB clamp aligns and protects the Device Interface PCB by sandwiching it between electrically shielded aluminum with a pliable conductive elastomer liner. The clamp frame design coupled with the pedestal support enhances multi-site RF signal isolation.

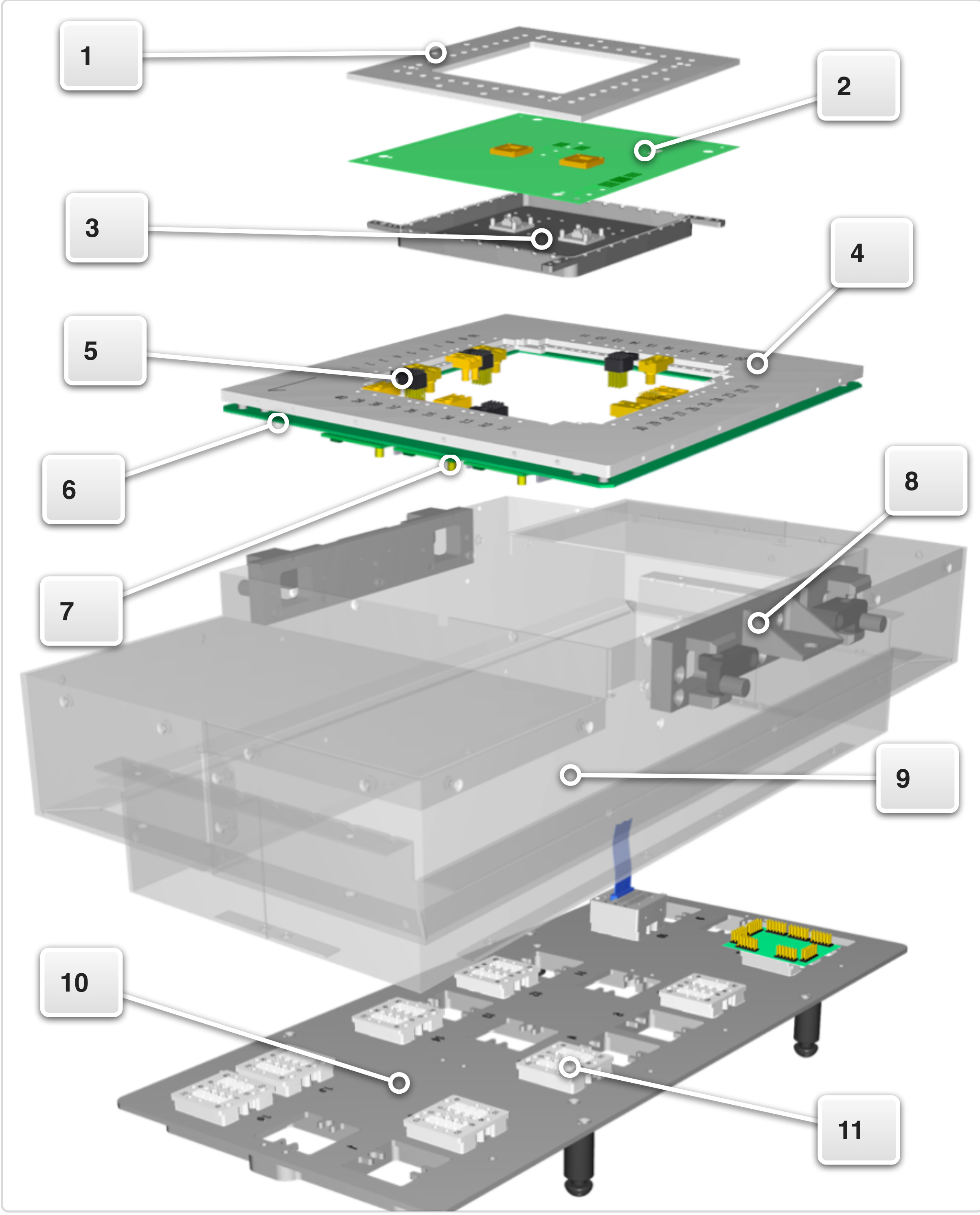
2. **Device Interface Board (DIB)** - with most of the application specific resources moved inside the fixture, the DIB consists of a 2-layer PCB with passive RF matching components and signal interconnect. With a solid ground plane on top and strip line microwave signal paths, the DIB delivers unmatched performance up to 40GHz, providing a low-cost solution for a high-wear component.

3. **Pedestal Support & Pedestals** - the Pedestals and Pedestal Support completes the Quick-Lock™ system. Aluminum pedestals and pedestal support provide reinforcement of the socket sites from underneath the PCB during handler insertion. The support housing doubles as both protection of the PCB as well as providing RF shielding and enhancing site isolation for the socket sites with a pliable, conductive elastomer liner.

4. **Top Plate** - the aluminum top plate frame incorporates a hinge top design for easy access to resources within the enclosure along with over 30 signal launch locations to support custom site topologies.

5. **Signal Launches** - standardized and interchangeable DC, high-speed digital, RF, and millimeter wave connectors that provide high performance, precision signal launching around the perimeter of the device interface board. The launches incorporate spring loaded pogo pins for DC and digital signal interfaces with the PCB. RF signal launches utilize a unique pressure contact and RF launch tab design on the PCB. Several RF launch designs offer differential pair, enhanced matching, and frequency range options.

FIGURE 1.1 ANATOMY OF A HARD-DOCK FIXTURE



6. **Fixture Carrier** - the fixture carrier PCB provides 13 standard fixture module locations in addition to static control bits and ±5V, ±15V, and +28V supply power distribution. The carrier includes interfaces with Cassini's RIFL test head data bus to bring integrated software identification, control, and RF path calibration into the device interface environment.

7. **Fixture Modules** - standardized instrument resources to extend and enhance TIM capabilities such as: RF switches, DC/RF relays, signal conditioning, parametric measure, and more.

8. **Docking Ears** - component of the mechanical handler docking system that allows the fixture to mount to an automated handler. The docking ears have 4 adjustable cams that capture the locking channels of a handler docking plate mounted around the handler's device through port. The ears provide built-in mechanical dampening and adjustable preload compliance to support the insertion force of a device for a variety of handler setups.

9. **Fixture Body** - the rugged aluminum enclosure provides protection of sensitive microwave components along with providing thermal and electrical shielding. The frame supports an integrated, precision handler docking system.

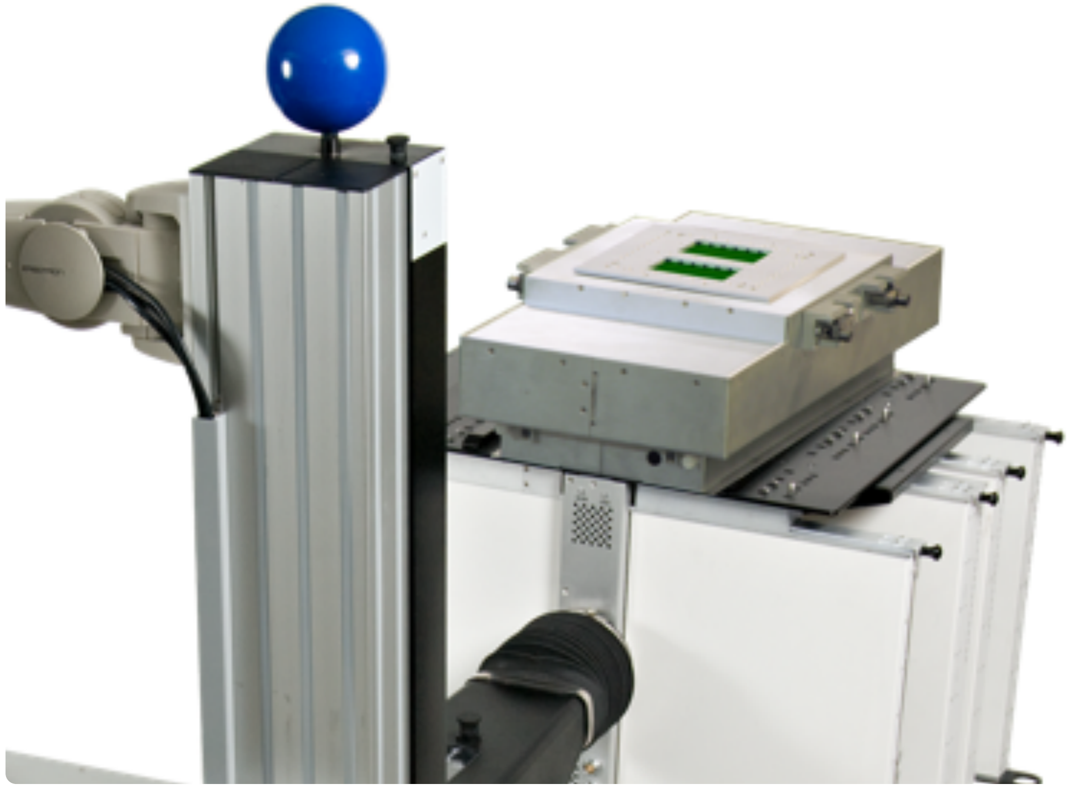
10. **Bottom Plate** - an aluminum plate with 16 universal TIM interface slots and standard docking pins for interfacing with Cassini's test head. Each TIM slot accommodates standard TIM interface blocks with precision mechanical compliance.

11. **TIM Interface Blocks** - standard, blind-mate signal interface blocks for all of Cassini's test instrument modules. The blocks bring all the TIM resources into the fixture for routing to other TIMs, additional instrument resources (switches, relays, ampliers, attenuators, etc.) or up to the device interface board to contact with a socketed device under test.

INSERTING & REMOVING FIXTURES

Fixtures and calibration/diagnostic plates are designed with test head docking fasteners, blind-mate TIM interface blocks, and alignment pins to make them easy to add and remove from the test system. These components provide easy access to test resources and require no teardown of the test setup when performing maintenance procedures on the tester. The methods for docking and undocking a fixture from the Cassini test systems are detailed in the following text.

FIGURE 1.2 FIXTURE INSTALLED ON CASSINI 16 TEST HEAD



Above is a Cassini 16 test system with a fixture installed on the test head.

Cassini 16

NOTE: Always use a 16 slot bottom plate/fixture when docking to a Cassini 16 test system.

TO DOCK A FIXTURE OR DIAGNOSTIC PLATE, FOLLOW THE STEPS BELOW:

1. Rotate the test head into the upright position and secure the rotation lock by putting it into the LOCKED position.
2. Position the manipulator arm into the MAINTENANCE POSITION using the locking latch found on top of the manipulator armature.
3. Insure that the TIM locations on the test head match the TIM interface blocks on the bottom plate of the fixture or calibration/ diagnostic plate.

CAUTION: Keyed pins on the TIMs and keyed receive openings on the TIM interface blocks are designed to prevent mismatched TIM/interface block mating but unintentional damage can occur if the instrument layout of the test head does not match the fixture's TIM interface blocks when docking.

4. Insure the docking rotary knob on the infrastructure is in the UNLATCHED position.
5. Verify that the test head is active and the docking system is operational by checking that both fixture docking LEDs (ALIGN and LOCK) on the side of the test head nearest the chassis are both red as shown in image 1 of Figure 1.3.
6. Holding the fixture or calibration/diagnostic plate along the short edges of the fixture or bottom plate with the docking pins facing downward, orient the alignment arrow (found on the fixture top plate or the sticker on a calibration/diagnostic plate) to point towards the infrastructure chassis. Bring the fixture or calibration/ diagnostic plate straight down onto the test head, checking that the docking pins move freely into position within their receive ports and interface blocks comply with their corresponding TIM alignment pins. Verify that the fixture orientation and alignment is correct by checking that the ALIGNMENT LED is now green and the LOCK LED is red (as shown in image 2 of Figure 1.3).

WARNING: Keep hands, loose clothing, and objects clear of the test head area where the fixture bottom plate docks. Serious injury to hands or fingers as well as damage to the test head, fixture, or pneumatic locking system can occur if this area is not kept clear.

NOTE: The fixture alignment must be correct, and ALIGN LED must be green to activate the pneumatic locking drive system.

7. The bottom plate or fixture should sit level on the test head and be slightly above flush relative to the finger guard on the test head that surrounds the bottom plate.
8. Turn the docking rotary knob to the LATCH position. The pneumatic drive force will engage the docking canoes underneath

the test head with the bottom plate docking pins, pulling the bottom plate down and flush across the finger guard.

9. Verify that the fixture has been successfully docked checking that the ALIGNMENT LED and the LOCK LED are now green (as shown in image 3 of Figure 1.3).
10. Perform a **System Check** to activate the fixture or calibration/ diagnostic plate resources in the test system software.

CAUTION: Always verify that both docking indicator lights are green before moving or rotating the test head to prevent accidental drop of the fixture or calibration/diagnostic plate.

When docking the test system to a handler, typically the fixture is docked to the handler first, and then the test system is positioned underneath or adjacent to the handler/fixture by rotating the test head accordingly and using the rolling castors. Fine adjustment is achieved through the electromechanical lift and 2-axis planar/gimbal movement to dock the system to the fixture/handler. The docking indicator lights are used to visually verify alignment and successful dock.

TO UNDOCK A FIXTURE OR DIAGNOSTIC PLATE:

1. Rotate the test head into the upright position and secure the rotation lock by putting it into the LOCKED position.
2. Position the manipulator arm into the MAINTENANCE POSITION using the locking latch found on top of the manipulator armature.
3. Turn the docking rotary knob on the infrastructure from the LATCH to the UNLATCH position.
4. Verify that the pneumatic lock disengages the docking canoes underneath the test head from the bottom plate docking pins by checking that the LOCK indicator light is now red. (The bottom plate should move away from the test head and slightly above flush across the finger guard on the test head.)
5. Remove the fixture or calibration/diagnostic plate from the test head by lifting upwards and away from the test head.
6. Perform a **System Check** to remove the fixture or calibration/ diagnostic plate resources from the test system software.
7. When undocking the test system from a handler, turn the rotary latching knob from the LATCH position to the UNLATCH position. The test system can be moved away from the handler/fixture using the fine adjustment electromechanical lift and 2-axis planar/ gimbal movement to undock. The test head can then be rotated back to upright and the system can be moved away using the rolling castors. The docking indicator lights can be used to visually verify undocking. The fixture can then be undocked from the handler.

FIGURE 1.3 Fixture Docking Indicator Lights

The docking indicator lights are located on the side of the test head nearest the infrastructure chassis. When the test head is powered up and active but no fixture or calibration/diagnostic plate is present both LEDs are red.

FIGURE 1.4 Fixture Docking Indicator Lights

When a fixture or calibration/docking plate is correctly oriented on the test head, the ALIGNMENT LED will change color to green while the LOCK LED will remain red enabling the pneumatic lock drive system.

FIGURE 1.5 Fixture Docking Indicator Lights

When the fixture or calibration/diagnostic plate has been successfully latched to the test head, the docking indicator lights will both be green.

RI7100C (Big Cassini)

NOTE: Always use an 8 slot bottom plate/fixture when docking to a RI7100C test system.

TO DOCK A FIXTURE OR DIAGNOSTIC PLATE:

1. Rotate the test head into the upright position and secure the rotation lock using the slide handle.
2. Position the manipulator arm for ease of access to the fixture and lock into place using the two rotary knobs on the armature.
3. Insure that the TIM locations on the test head match the TIM interface blocks on the bottom plate of the fixture or calibration/ diagnostic plate.

CAUTION: Keyed pins on the TIMs and keyed receive openings on the TIM interface blocks are designed to prevent mismatched TIM/interface block mating but unintentional damage can occur if the instrument layout of the test head does not match the fixture's TIM interface blocks when docking.

4. Holding the fixture or calibration/diagnostic plate along the perimeter of the fixture or perimeter of the bottom plate with the docking pins facing downward, orient the alignment arrow (found on the fixture top plate or the sticker on a calibration/diagnostic plate) to point at the instrument rack. Bring the fixture or calibration/diagnostic plate straight down onto the test head, checking that the docking pins move freely into position within their receive ports and interface blocks comply with their corresponding TIM alignment pins.
5. The bottom plate or fixture should sit level on the test head and be slightly above flush relative to the finger guard on the test head that surrounds the bottom plate.

WARNING: Keep hands, loose clothing, and objects clear of the test head area where the fixture bottom plate docks. Serious injury to hands or fingers as well as damage to the test head, fixture, or pneumatic locking system can occur if this area is not kept clear.

6. Depress the fixture lock release switch located on the side of the test head nearest to the instrument rack(See Cassini Reference Guide) and manually actuate the canoe locks using the hand grips on the test head as shown in image 1 of Figure 1.7.

NOTE: Depressing the solenoid release switch for an extended period of time (> 5-10 seconds) results in excess current through the switch. To prevent damage, the button has a built-in, cool down mode before reuse. The button will flash indicating the solenoid release is temporarily disabled during this cool-off period.

7. The locking canoes will engage the fixture docking pins, pulling the bottom plate down against the test head.
8. Perform a **System Check** to activate the fixture or calibration/ diagnostic plate in the test system software.

TO UNDOCK A FIXTURE OR DIAGNOSTIC PLATE:

1. Rotate the test head into the upright position and secure the rotation lock by putting it into the LOCKED position.

2. Position the manipulator arm for ease of access to the fixture and lock into place using the two rotary knobs on the armature.

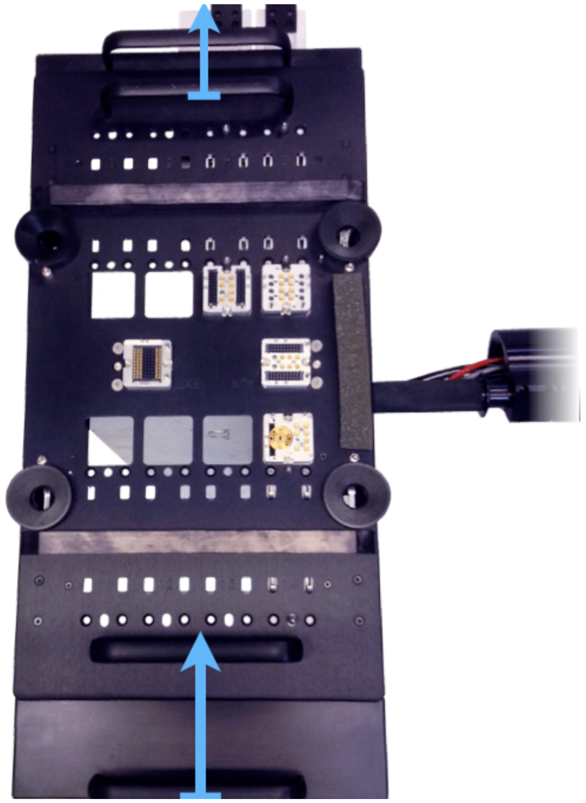
3. Depress the fixture lock release switch located on the side of the test head nearest to the instrument rack(reference Figure -.- for location) and manually actuate the canoe locks using the hand grips on the test head as shown in image 2 of Figure 1.7.

NOTE: Depressing the solenoid release switch for an extended period of time (> 5-10 seconds) results in excess current through the switch. To prevent damage, the button has a built-in, cool down mode before reuse. The button will flash indicating the solenoid release is temporarily disabled during this cool-off period.

4. The locking canoes will disengage the fixture docking pins, releasing the bottom plate from the test head allowing for removal.

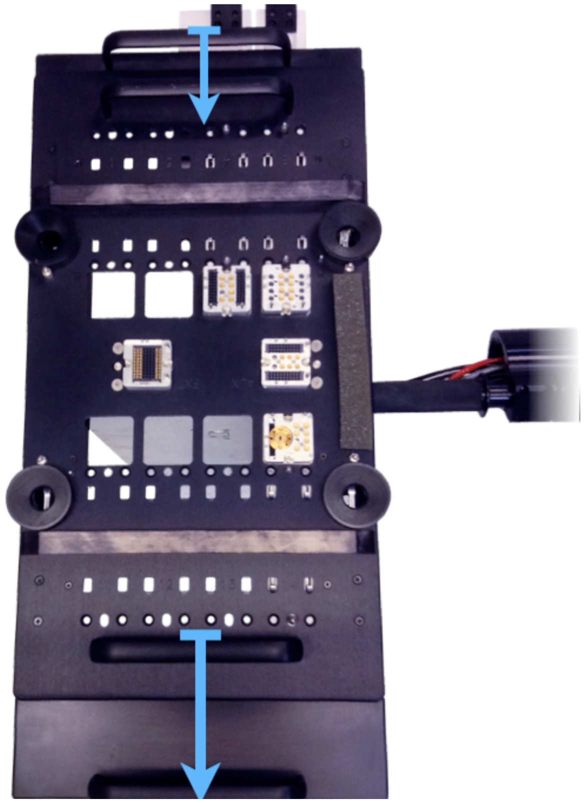
5. Perform a **System Check** to remove the fixture or calibration/ diagnostic plate resources from the test system software.

FIGURE 1.6 CASSINI 8/RI7100C FIXTURE DOCKING HANDLES



Actuation movement for locking a fixture to the test head.

FIGURE 1.7 CASSINI 8/RI7100C FIXTURE DOCKING HANDLES



Actuation movement for unlocking a fixture from the test head.

CASSINI 8

NOTE: Always use an 8 slot bottom plate/fixture when docking to a Cassini 8 test system.

TO DOCK A FIXTURE OR DIAGNOSTIC PLATE:

1. Rotate the test head into the upright position and secure the rotation lock using the slide handle.
2. Position the manipulator arm for ease of access to the fixture and lock into place using the two rotary knobs on the armature.
3. Insure that the TIM locations on the test head match the TIM interface blocks on the bottom plate of the fixture or calibration/ diagnostic plate.

CAUTION: Keyed pins on the TIMs and keyed receive openings on the TIM interface blocks are designed to prevent mismatched TIM/interface block mating but unintentional damage can occur if the instrument layout of the test head does not match the fixture's TIM interface blocks when docking.

4. Holding the fixture or calibration/diagnostic plate along the perimeter of the fixture or perimeter of the bottom plate with the docking pins facing downward, orient the alignment arrow (found on the fixture top plate or the sticker on a calibration/diagnostic plate) to point at the instrument rack. Bring the fixture or calibration/diagnostic plate straight down onto the test head,

checking that the docking pins move freely into position within their receive ports and interface blocks comply with their corresponding TIM alignment pins.

5. The bottom plate or fixture should sit level on the test head and be slightly above flush relative to the finger guard on the test head that surrounds the bottom plate.

WARNING: Keep hands, loose clothing, and objects clear of the test head area where the fixture bottom plate docks. Serious injury to hands or fingers as well as damage to the test head, fixture, or pneumatic locking system can occur if this area is not kept clear.

6. Depress the fixture lock release switch located on the side of the test head nearest to the instrument rack(reference the Cassini Reference Guide for location) and manually actuate the canoe locks using the hand grips on the test head as shown in image 1 of Figure 1.7.

NOTE: Depressing the solenoid release switch for an extended period of time (> 5-10 seconds) results in excess current through the switch. To prevent damage, the button has a built-in, cool down mode before reuse. The button will flash indicating the solenoid release is temporarily disabled during this cool-off period.

7. The locking canoes will engage the fixture docking pins, pulling the bottom plate down and flush across the finger guard.

8. Perform a **System Check** to activate the fixture or calibration/diagnostic plate in the test system software.

TO UNDOCK A FIXTURE OR DIAGNOSTIC PLATE:

1. Rotate the test head into the upright position and secure the rotation lock by putting it into the LOCKED position.

2. Position the manipulator arm for ease of access to the fixture and lock into place using the two rotary knobs on the armature.

3. Depress the fixture lock release switch located on the side of the test head nearest to the instrument rack (reference the Cassini Reference Guide for location) and manually actuate the canoe locks using the hand grips on the test head as shown in image 2 of Figure 1.7.

NOTE: Depressing the solenoid release switch for an extended period of time (> 5-10 seconds) results in excess current through the switch. To prevent damage, the button has a built-in, cool down mode before reuse. The button will flash indicating the solenoid release is temporarily disabled during this cool-off period.

4. The locking canoes will disengage the fixture docking pins, releasing the bottom plate from the test head allowing removal.

5. Perform a **System Check** to remove the fixture or calibration/diagnostic plate resources from the test system software.

SHIPPING REQUIREMENTS

Factory assembled fixtures are shipped inside a shipping container with a specially designed fixture storage crate. Fixtures should always be packaged and shipped using the Roos Instrument's provided container and storage crate.

DO NOT discard these containers. They are designed specifically for the instruments and TIMs with adequate sizing, anti-static material, and conformal padding to protect them during transport. If this container and shipping material are not available, contact Roos Instruments for packing instructions.

Damage to fixtures during shipping is the responsibility of the shipping party. Roos Instruments assumes liability for damage of equipment shipped from the factory. Roos Instruments is not liable for shipping damage of equipment shipped to Roos Instruments for service, repair, or otherwise.

SERVICE INFORMATION

If a product is being returned to Roos Instruments for service or repair, please provide adequate information to help expedite repair and return of the product. For best service results, include information such as: symptoms, date of failure, the current status of the instrument, etc.

Items for return must include a Return Merchandise Authorization (RMA) number. To obtain an RMA number, please email support@roos.com or contact Roos Instruments at 1.408.748.8589 between the hours of 9:00 a.m. to 6:00 p.m. (U.S. Pacific Standard Time)

A return of fixture or fixture components outside of warranty repair must be requested within 30 calendar days of receipt(ship date for credit card orders). A Return Merchandise Authorization (RMA) must be requested from Roos Instruments support within this time period. NO returns of any type will be accepted without an RMA number and ALL returns must be shipped prepaid and insured via any common carrier (i.e. UPS, FedEx).

NOTE: To expedite processing, please include the RMA number on the shipping manifest and/or within the shipping container. Shipment tracking information is required.

PACKAGING A FIXTURE

Proper packaging of fixtures prevents damage and improves response time for repair and replacement. Every fixture should be individually boxed with the supplied shipping container, storage crate, and packaging provided by Roos Instruments following the instructions below:

The fixture should be placed inside the provided shipping containers. If not available, the fixture should be shipped in a container with the following specifications:

- Single Wall Corrugated
- Bursting Test: 200 lb./sq. inch
- Min Comb WT Facings: 84 lbs per m sq ft
- Size Limit: 75 inches
- Gross Weight Limit: 65 pounds
- Min Dimensions: 30"x24"x12"

The box used should allow for at least 3 inches of isolation between the fixture and box walls (not including the thickness of the bubble wrap).

Avoid placing styrofoam or packaging material in and around interface pins and ports as well as the interior of the fixture as this may damage connectors, cables, etc.

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DEVICE INTERFACE LAYER

2

The Device Interface Layer chapter provides information about:

- Device Interface Board (DIB) Options
- Quick-Lock DIB System
- Mechanical Specifications for DIB, DIB Clamp, Pedestal Support Types
- PCB Design Specifications
- PCB Design Guidelines

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Overview

The top layer components of Cassini fixtures serve as the signal interface translation of direct-current, digital, microwave, and millimeter wave interconnect from the tester to the device under test. There are essentially two types of top layer interfaces:

- Soft-dock: bulkhead resource adapter environment that supports standard COTS bulkhead connectors
- Hard-dock: environment for using various Printed Circuit Board (PCB) designs with mounted sockets for mapping resources to a package IC

Typically a soft-dock fixture configuration is used to to route test resources to a probe station or board/module test bench setup. A hard-dock configuration is used for testing packaged ICs with an automated handler. The different types and components of these two fixture top layer configurations are described in the following text.

Hard-Dock Components

The hard dock configuration consists of five components:

1. **Pedestal Support** - precision-milled aluminum bracket that provides pedestal mounting positions. The pedestal support reinforces the socket sites from underneath during handler insertion with aluminum pedestals. The housing has four tapped screw hole location on the extending corners that capture screws from the DIB Clamp. These hold the DIB clamp, DIB, and pedestal support together as a single unit. The perimeter of the support contains an inlay channel containing conductive elastomer. The elastomer inlay provides both a malleable surface contact connection to the surface of the PCB, preventing damage when the pedestal support is installed as well as providing enhanced RF shielding and signal isolation.

2. **Pedestal** - abutment structure typically made of non-conductive, high-density polymer or aluminum that braces and reinforces the PCB under the socket site to prevent mechanical deformation or vertical movement along the PCB's z-axis during handler insertion. Multiple types of pedestals can be supported and are typically affixed to the pedestal support with standard countersunk screws from the underside of the pedestal support. An example pedestal support is provided in Figure 2.2.

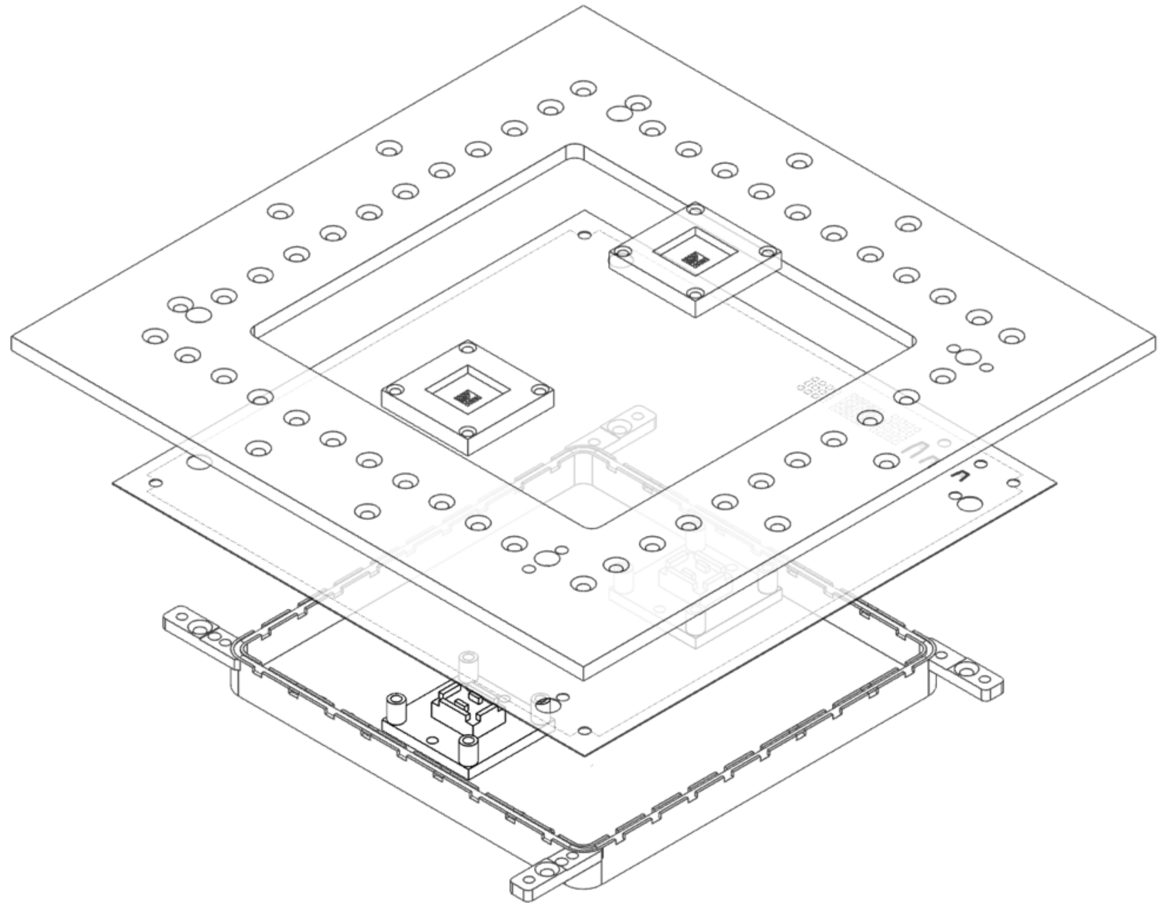
3. **Device Interface Board (DIB)** - printed circuit board that routes test resources to and from the device under test. High-frequency

RF and microwave devices typically use a 2-layer PCB with a solid ground plane and strip-line microwave signal paths. An example DIB is shown in Figure 2.3.

4. **Device Interface Board (DIB) Clamp** - aluminum plate that aligns the PCB and pedestal support to correctly orient and protect the PCB by compressing it between electrically-grounded aluminum. The clamp frame design comes in multiple types, designed to match a corresponding pedestal support for various multi-site or application-specific PCB signal resource layouts. The DIB clamp uses four standard, countersunk screws to affix the plate to the top plate of the fixture. A channel groove is milled into the underside of the DIB clamp to inlay conductive elastomer. The elastomer inlay provides both a malleable surface contact connection to the surface of the PCB, preventing damage when the pedestal support is installed as well as providing enhanced RF shielding and signal isolation. An example of a DIB clamp is provided in Figure 2.4.

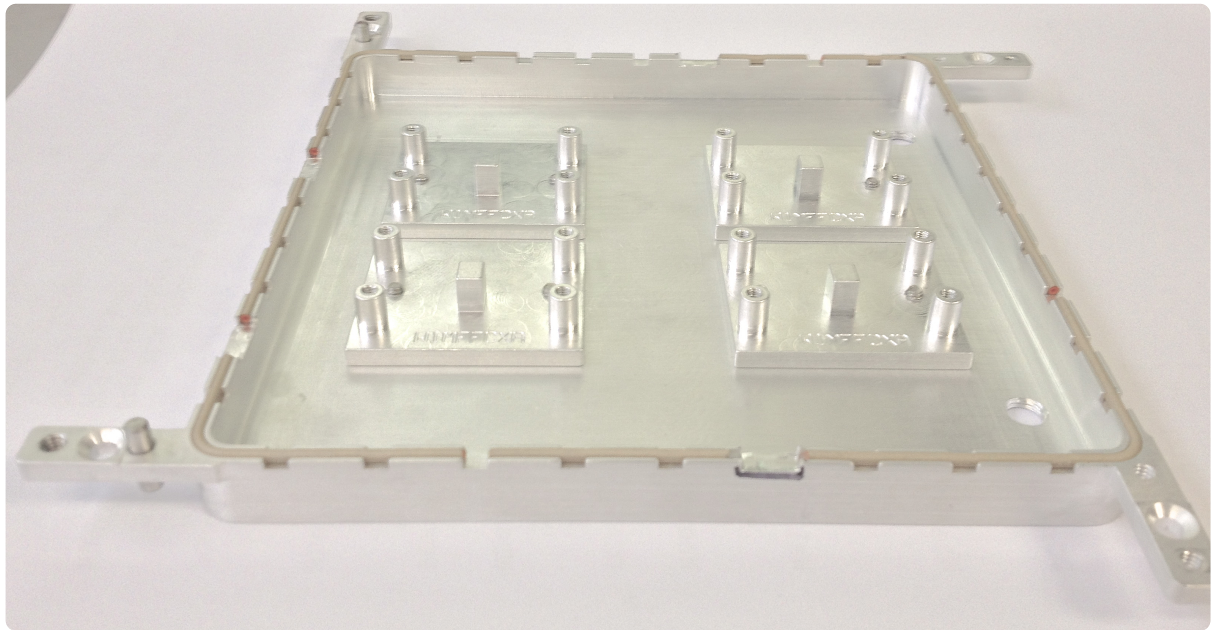
Figure 1.1 provides an exploded view of a typical hard-dock configuration. There are several types of the pedestal supports, pedestals and DIB clamps to support multiple site configurations, specific application requirements, and/or handler-specific requirements.

FIGURE 2.1 DIB "SANDWICH" ASSEMBLY



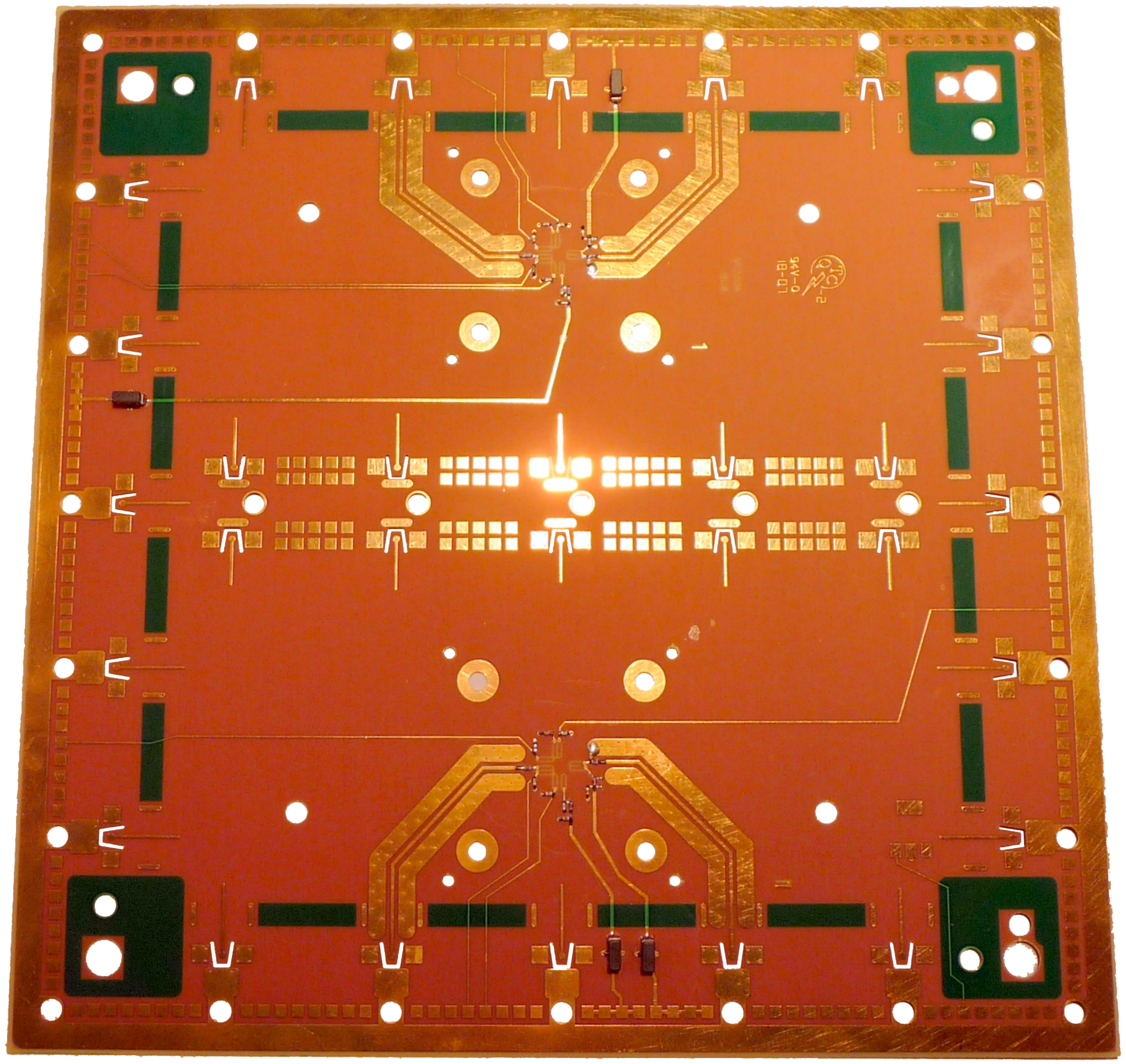
The above graphic shows an exploded view of the components of what is commonly referred to as the DIB "sandwich" assembly: DIB Clamp, DIB with sockets, Pedestal Support with Pedestals.

FIGURE 2.2 EXAMPLE OF A PEDESTAL SUPPORT WITH PEDESTALS



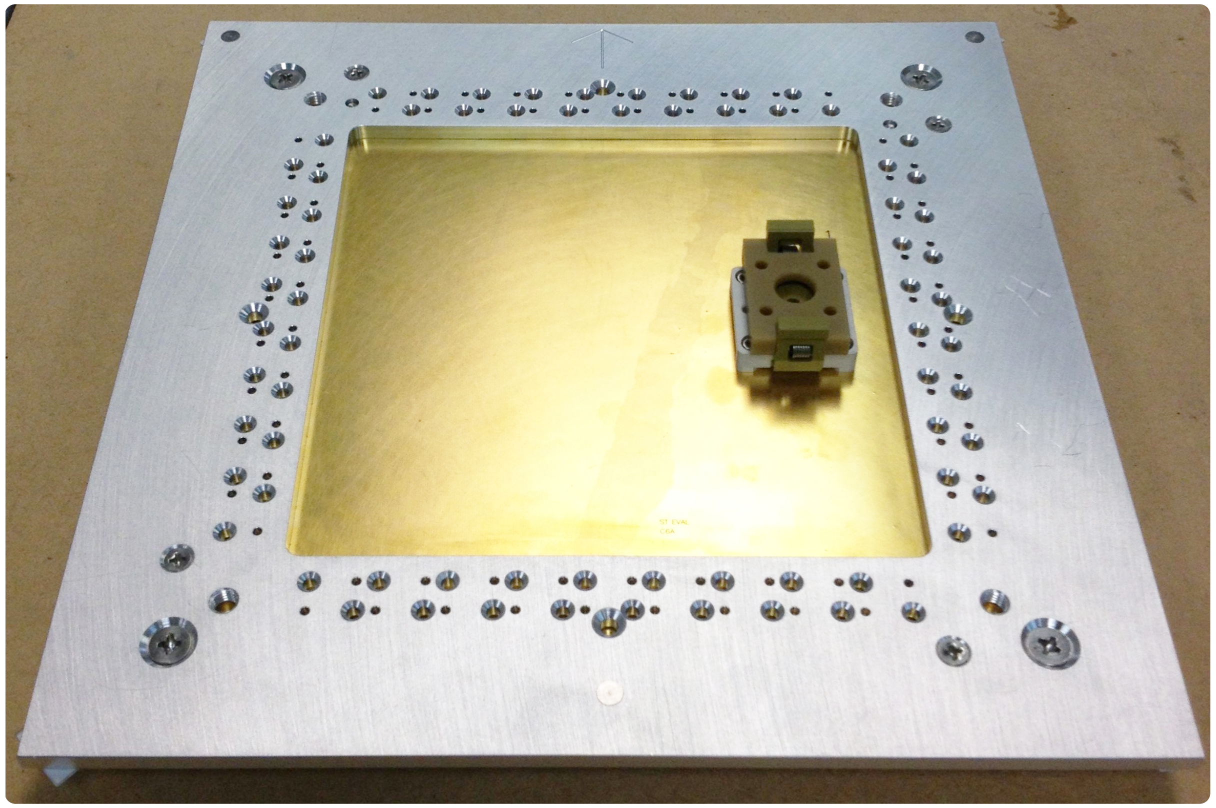
The above shows a typical pedestal support with four pedestals to support a four socket or "quad-site" multi-site configuration.

FIGURE 2.3 EXAMPLE OF A DEVICE INTERFACE BOARD (DIB)



The above shows a typical 2-layer, 12-mil device interface board. The view as shown from the fixture side has signal launch pads located around the perimeter of the board with DC,digital and RF traces routed to two, symmetric socket sites

FIGURE 2.4 EXAMPLE OF A DIB CLAMP

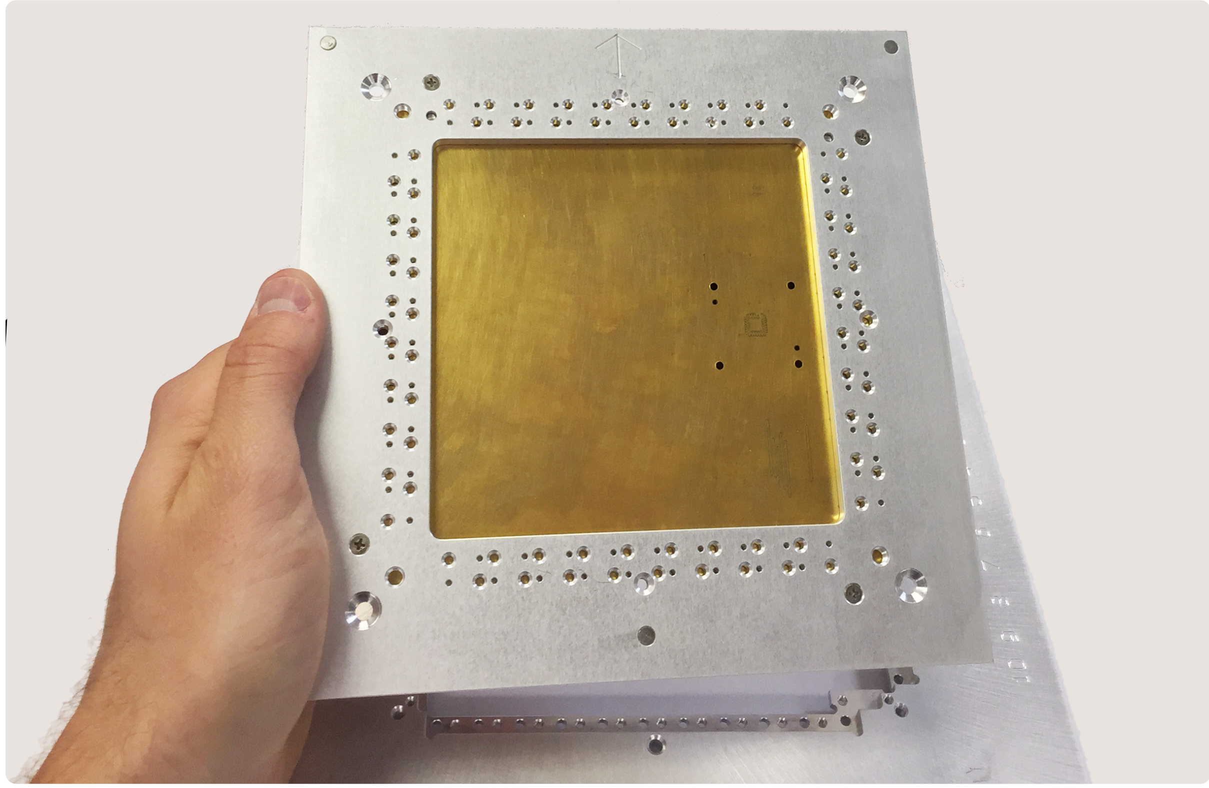


The example shows a PCB with socket secured with a standard Quick-Lock compatible DIB clamp.

QUICK-LOCK™

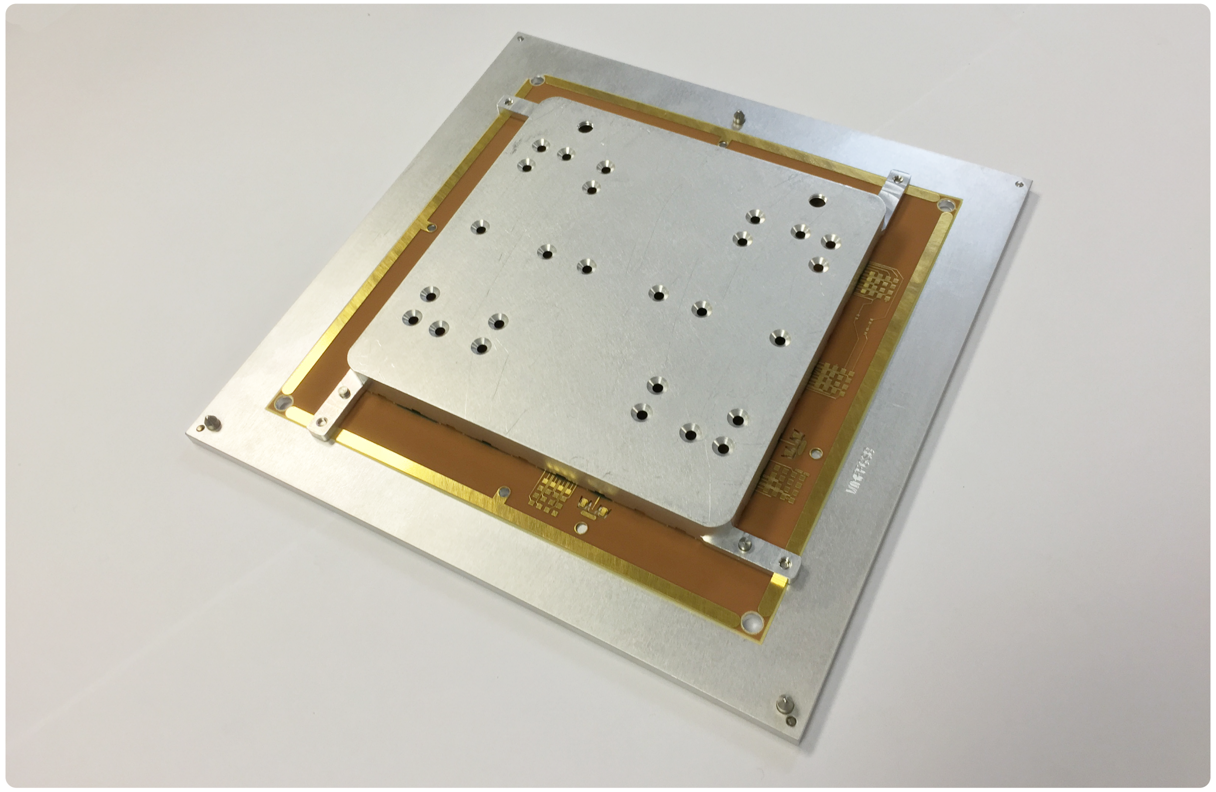
The Quick-Lock™ system provides removal and replacement of the pedestal support, DIB, and DIB clamp as a single unit from a Cassini fixture for rapid changeout and servicing. This is particularly useful in production test to minimize tester downtime when replacing a damaged or worn socket and/or PCB. Quick-lock compatible DIB supports and DIB clamps can be removed/installed via four standard screws on the DIB clamp. An example is provided in Figure 2.5 and Figure 2.6. Top layer components in this section that support this system will be denoted with a "Compatible with Quick-Lock™" designation.

FIGURE 2.5 Example of Quick-Lock DIB



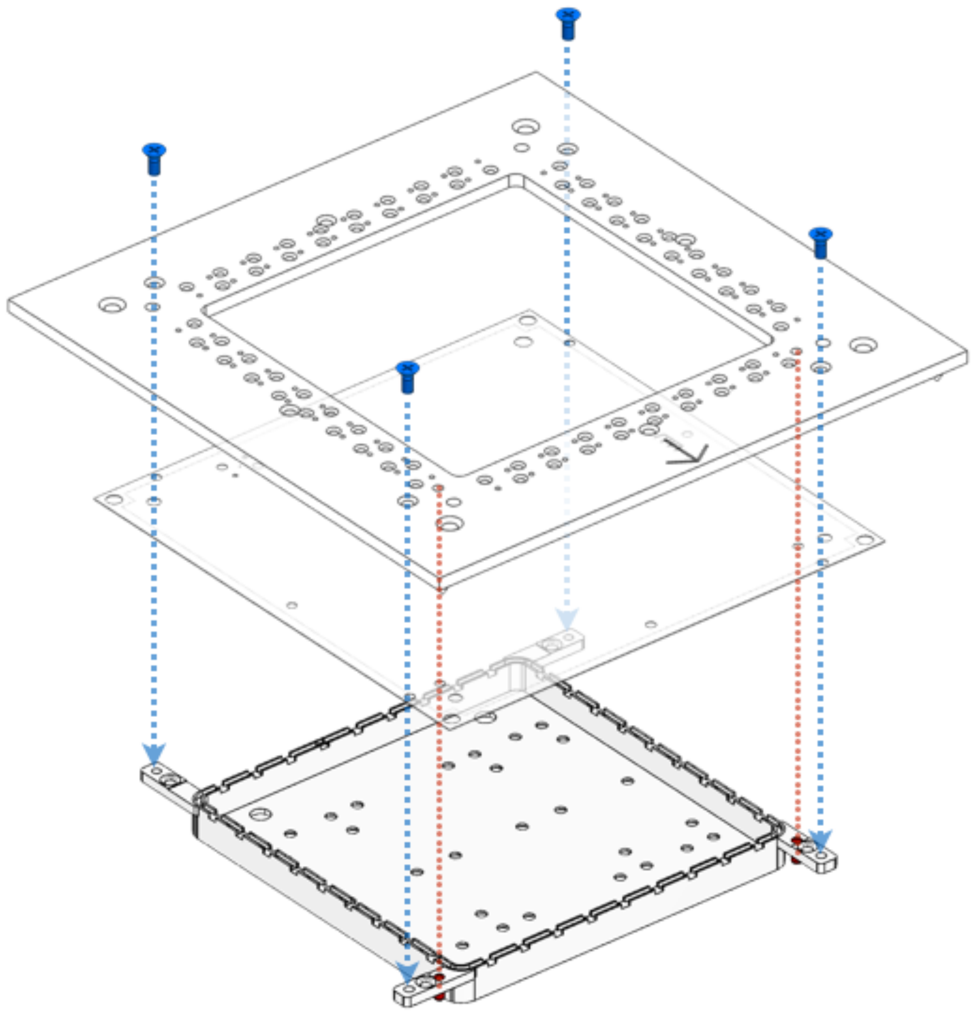
The DIB, pedestal support and DIB clamp can be removed from the fixture as a single unit.

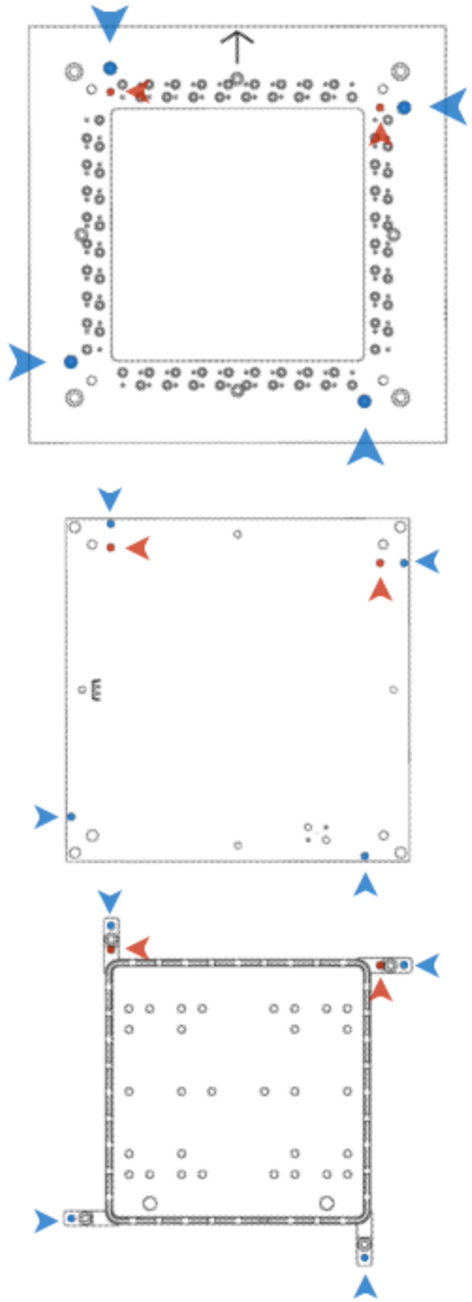
FIGURE 2.6 Example of Quick-Lock DIB



The underside of the DIB is exposed around the perimeter of the pedestal support allowing the signal pads to contact with the signal launches installed on the top plate. Connections are made with pressure contact of the pads to the launches when the securing screws are installed.

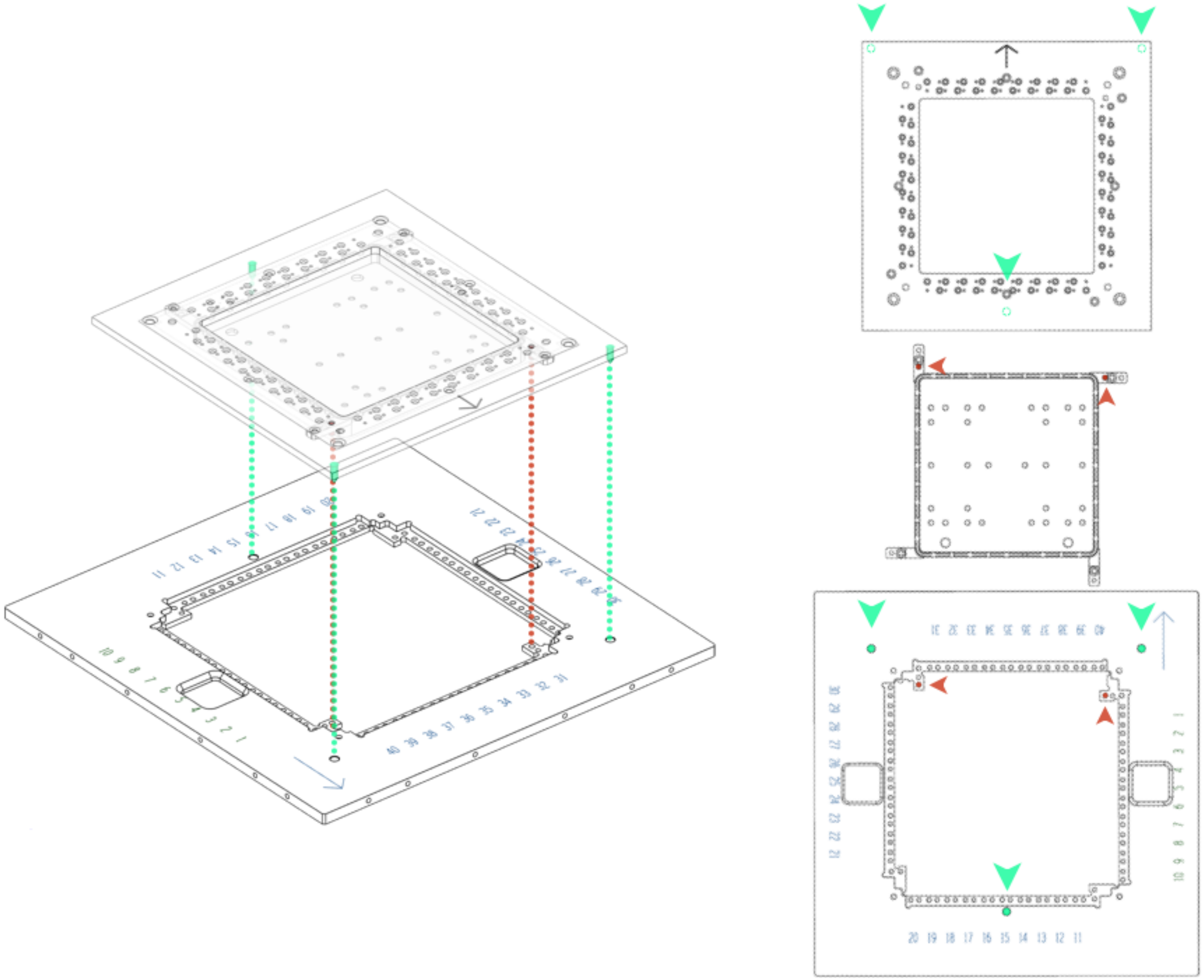
FIGURE 2.7 QUICK-LOCK ASSEMBLY





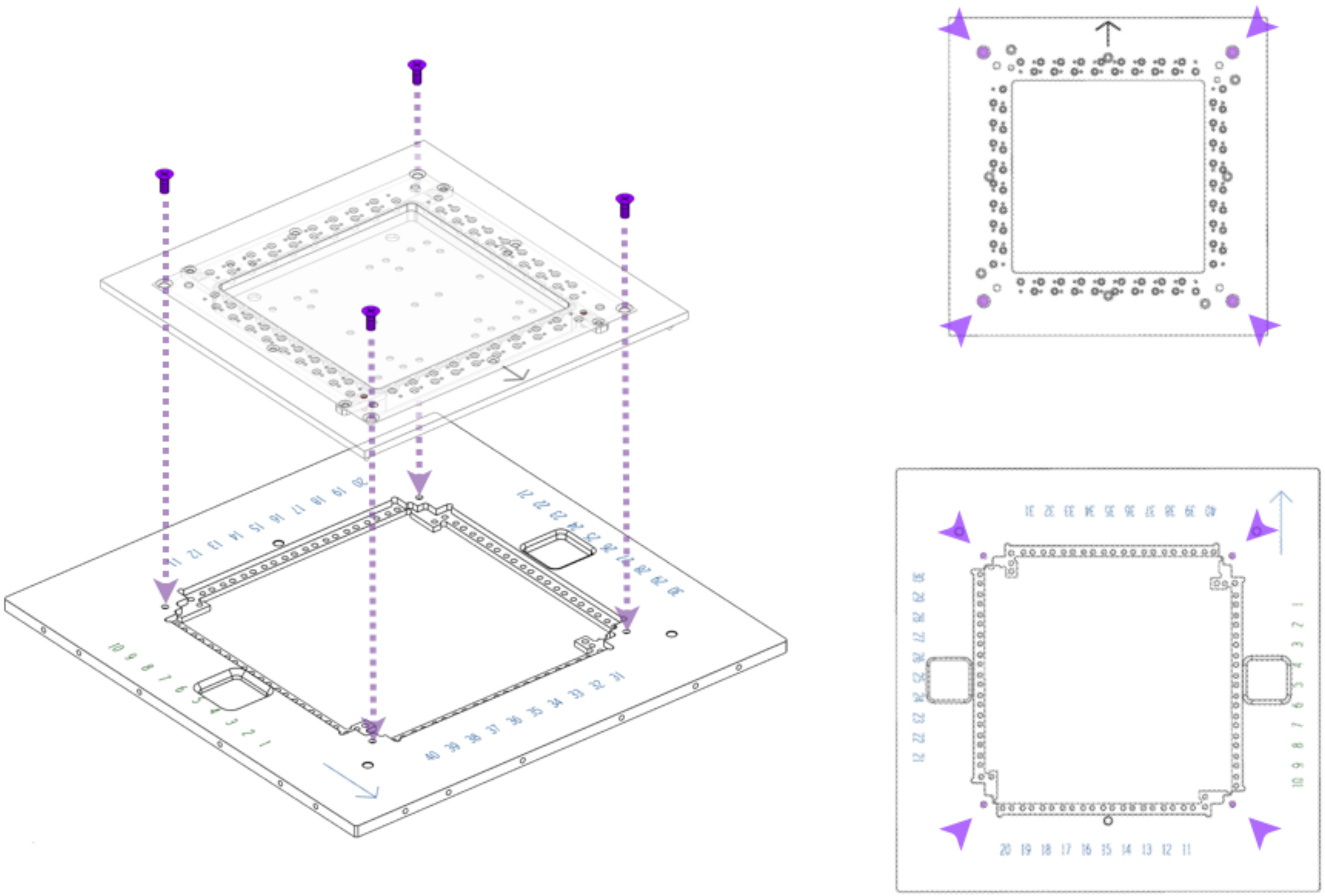
The PCB is oriented onto the pedestal support via two alignment pins(red). The four 4-40x5/16" screws(blue) hold the three components together as a single unit.

FIGURE 2.8 Quick-Lock Alignment



Five alignment pins orient the DIB to the top plate: two pins from the pedestal support that were used to align the PCB(red), and three pins on the bottom of the DIB clamp(green). Alignment arrows point to Cassini tester.

FIGURE 2.9 INSTALLING THE QUICK-LOCK DIB



The Quick-Lock "DIB Sandwich" can be secured to or removed from the fixture top plate using four 8-32 x 3/8" screws as shown above. These allow for rapid changeout of the DIB assembly.

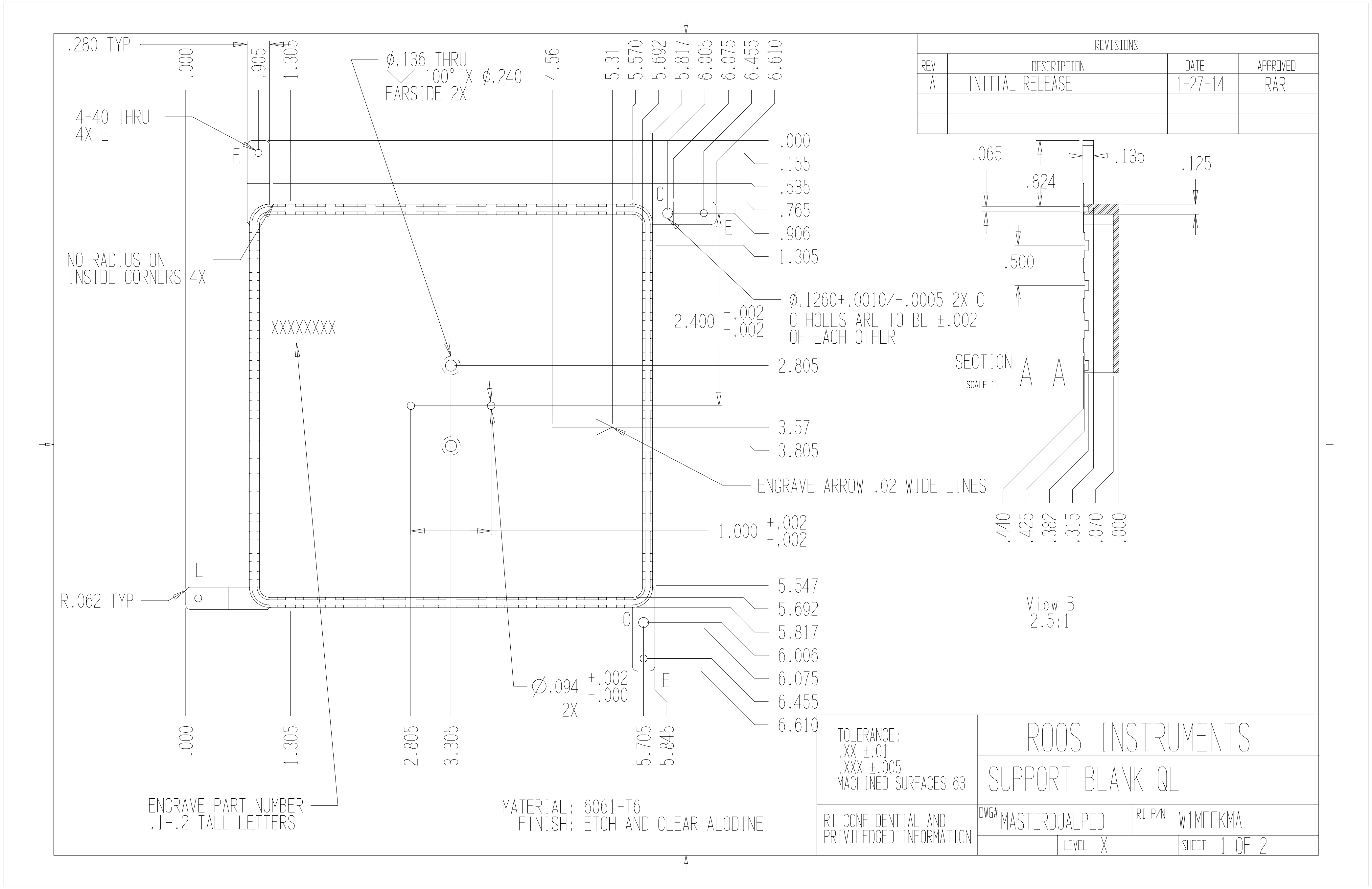
Mechanical Specifications

This section contains dimensions and specifications of the pedestal support, DIB Clamp, and example PCBs for reference.

NOMENCLATURE:

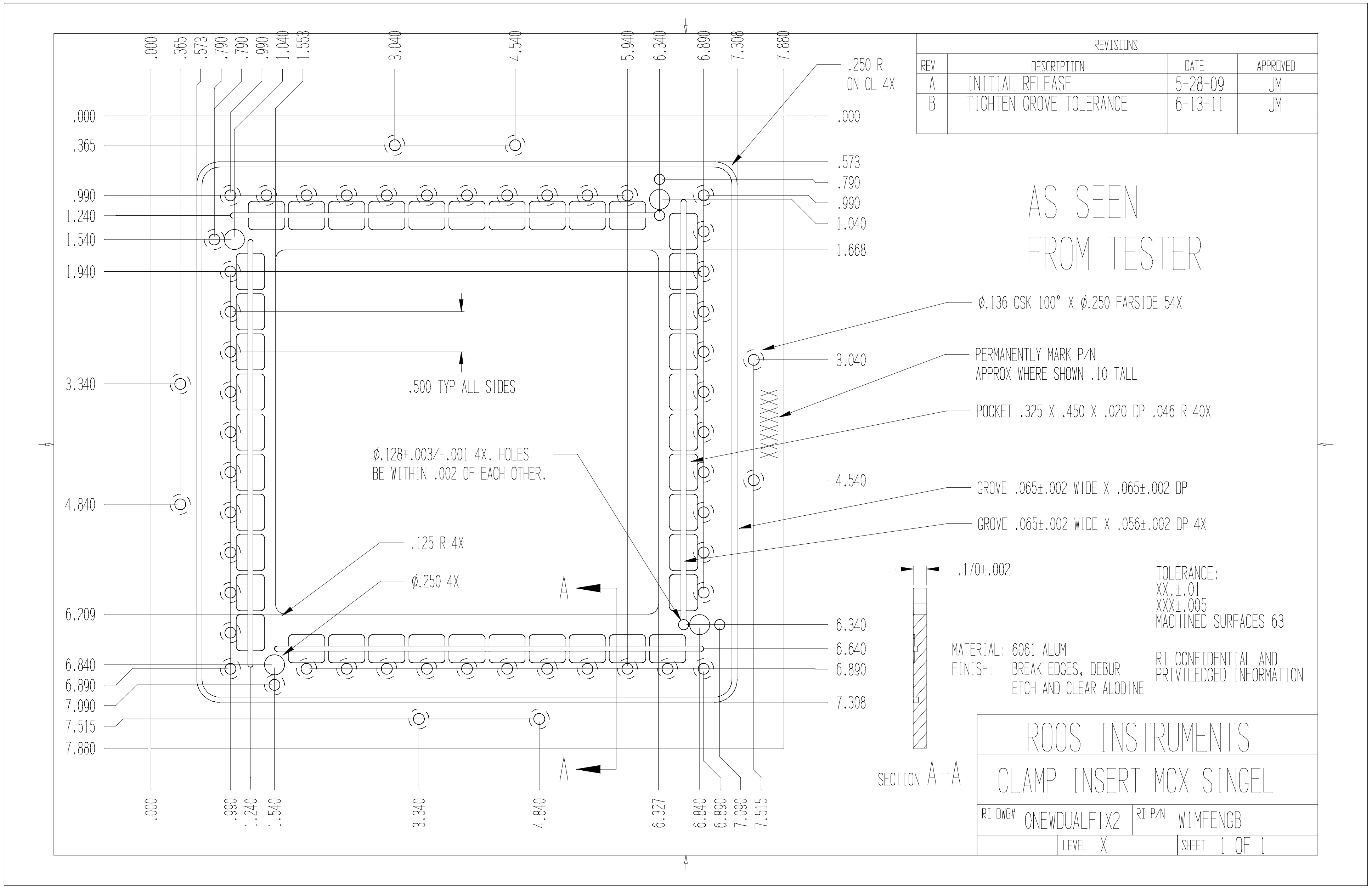
- A view of a component from the “top side”, “handler side”, “socket side”, or “as seen from above” refers to viewing the component from the perspective of above and looking down when correctly installed in the fixture.
- A view of a component from the “bottom side”, “fixture side”, “tester side”, or “as seen from below” refers to viewing the component from the perspective of underneath and looking up when correctly installed in the fixture.

FIGURE 2.10 Pedestal Support Dimensions



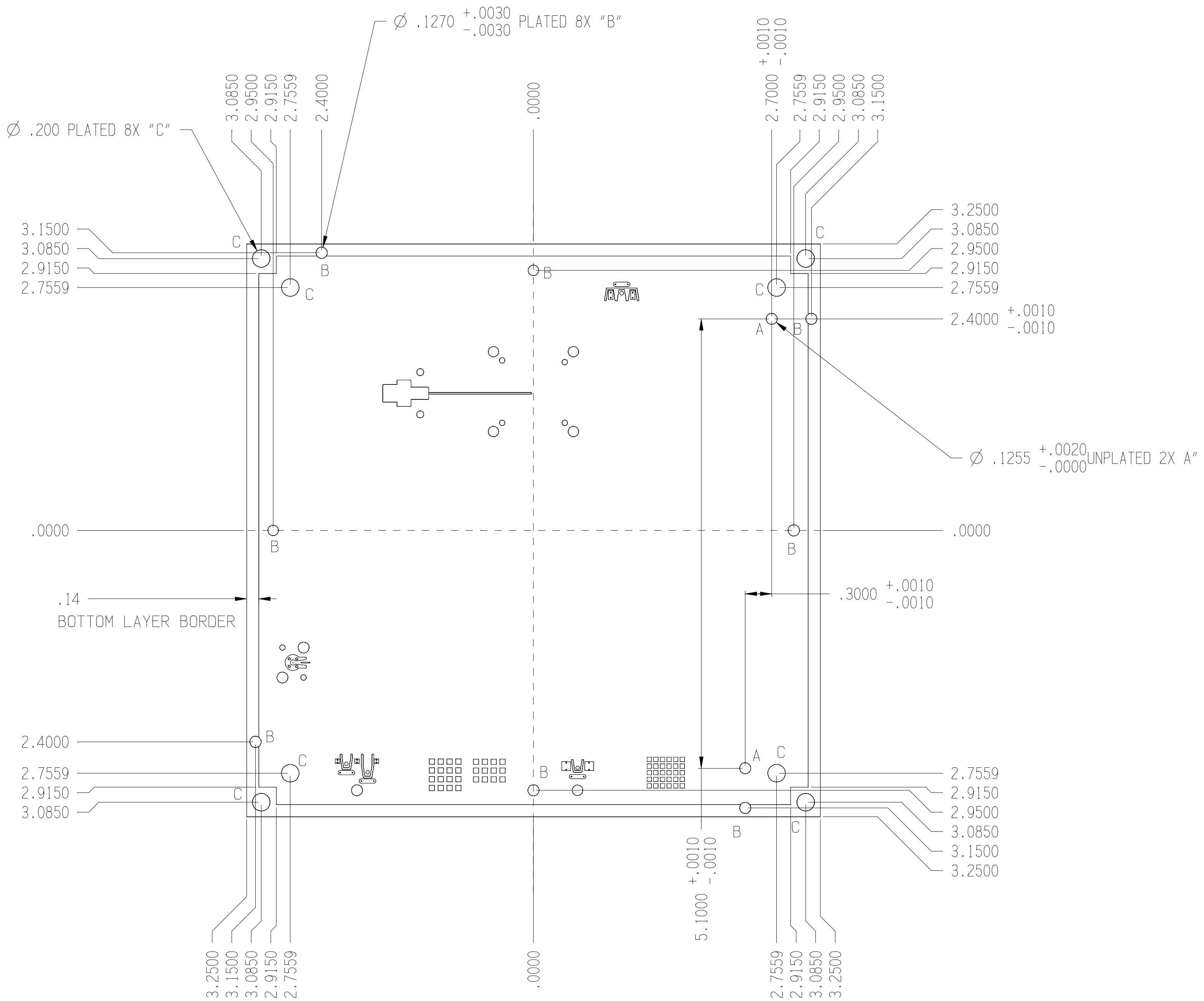
The above shows critical dimensions of a standard pedestal support as seen from the top/handler side for reference.

FIGURE 2.11 DIB Clamp Dimensions



The above shows critical dimensions of a standard DIB clamp as seen from the bottom/fixture side for reference.

FIGURE 2.12 Device Interface Board (DIB) Critical Size & Thru Hole Dimensions



The above shows the critical hole locations and dimensions of a standard device interface PCB as seen from the bottom/fixture side. The hole dimensions listed are after electroplating.

PCB Specifications

This section contains PCB material and dimension specifications for design compliance with standard Cassini fixtures. Critical dimensions for PCB size and alignment holes are provided in the Mechanical Specifications section, Figure 2.12.

GENERAL REQUIREMENTS:

Below are the PCB fabrication requirements for compliance with standard device interface compliance with Cassini fixture components.

Rogers 4359, 0.010" +/- 0.002" Core is the recommended PCB material.

The following text must be included in the fabrication notes of the PCB design layout:

- DIB orientation to the Top Plate, when looking down at the Fixture, is with the "RI" label in the lower right corner with "Tester" arrow pointing up and the "1" location for an Insert in the upper right corner incrementing clockwise with 10 Insert positions per side.
- Critical unplated alignment holes located top left and right.
- Inserts are 1/2 inch apart, centered on the middle Insert from the center of the DUT board.
- Handler position is usually opposite the "Tester" Infrastructure, and so would be "down" when looking at this DIB design.
- Any soldered components should be mounted on the bottom layer, very close to socket, leaving four symmetrical holes for a pedestal. Take note of keep away defined by pedestal lands**.**
- Socket Pin1 location can be anywhere, clearly marked in the lower left corner in this example.
- All dimensions INCH, US American ANSI Standard.
- Unless otherwise specified, .XX +/- 0.015 and .XXX +/- 0.003
- Cutout 0.020 Diameter Routed Per ROUTE.GBR, unplated. Gerber shows center of path.
- Top Side Ground Plane
- 0.015 Trace Tolerance +/- 0.002
- Two 0.005 slots in the top ground layer are AFTER gold plating and should have width adjusted as appropriate.
- No Loading Legend

- All hole diameters are AFTER Plating Material
- 1/2 OZ Copper Min Both Layers
- Copper Plating in All Holes to be 0.001 Minimum
- Finish, minimum of 50µin Hard Gold over 200µin Nickel
- Critical area is Top Side GND Plane Fingers
- Board must be ELECTROPLATED hard gold on nickel plating:

  Nickel Per ASTM B689-97, Type 2 Class 5

  Gold per ASTM B488-01, Type 1, Hardness C, Class 0.50
- Critical hole location is unplated X to its clearance pad +/- 0.002
- Locate all plated holes within 0.003 of Pad Center

PCB Design Guidelines

This section contains general PCB layout guidelines to comply with the design requirements of Cassini fixtures.

Orientation

The orientation of the PCB within the DIB clamp and pedestal support is defined by the critical dimension holes denoted in Figure 2.12:

- The ‘A’ thru holes capture the alignment pins of the pedestal support. These provide DIB alignment and orientation with the top plate and signal launches.
- The ‘B’ thru holes allow 4-40 type screws from the DIB clamp to capture their corresponding tap screw holes in the pedestal support, securing the PCB between them as a single unit.

When designing the signal launch footprints on the PCB, verify the PCB’s orientation matches the top plate signal launch layout orientation. See Figure 2.7 and Figure 2.8 in the Device Interface Layer - Overview section for reference.

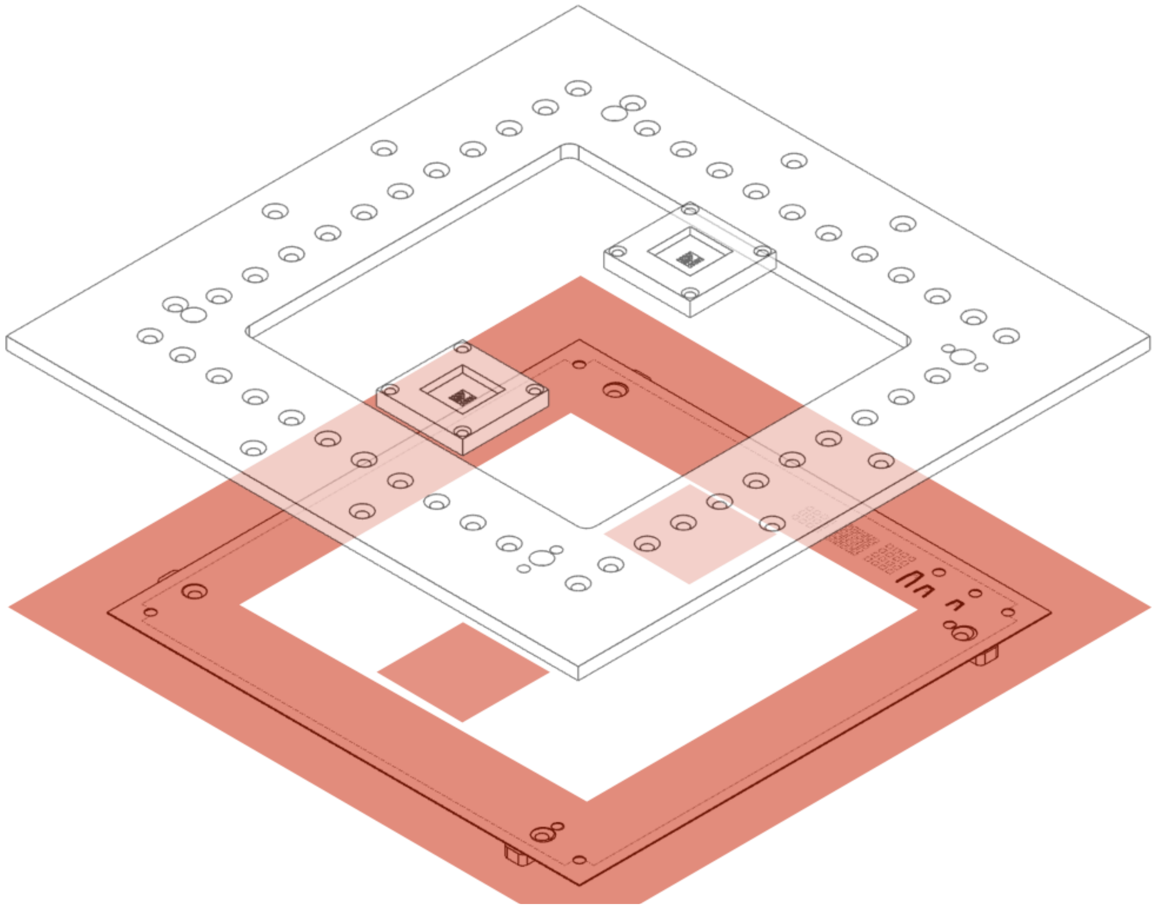
Keep Out Areas

Keep out areas designate regions of the PCB that must be kept free of surface mounted components and/or any physical objects that change the surface of the PCB. These areas are reserved for mechanical enclosures and components, specific to Cassini fixtures, that contact the surface of the PCB and ensure compliance. The following text provides information about these designated areas on the PCB as they pertain to the different types of pad and signal trace layouts.

DIB CLAMP

The perimeter region on the top/handler side of the PCB must be kept clear of surface mount components to allow the DIB Clamp to properly seat to the surface of the PCB. This keep out region is illustrated in Figure 2.13.

FIGURE 2.13 PCB KEEP OUT AREAS (TOP/HANDLER SIDE)

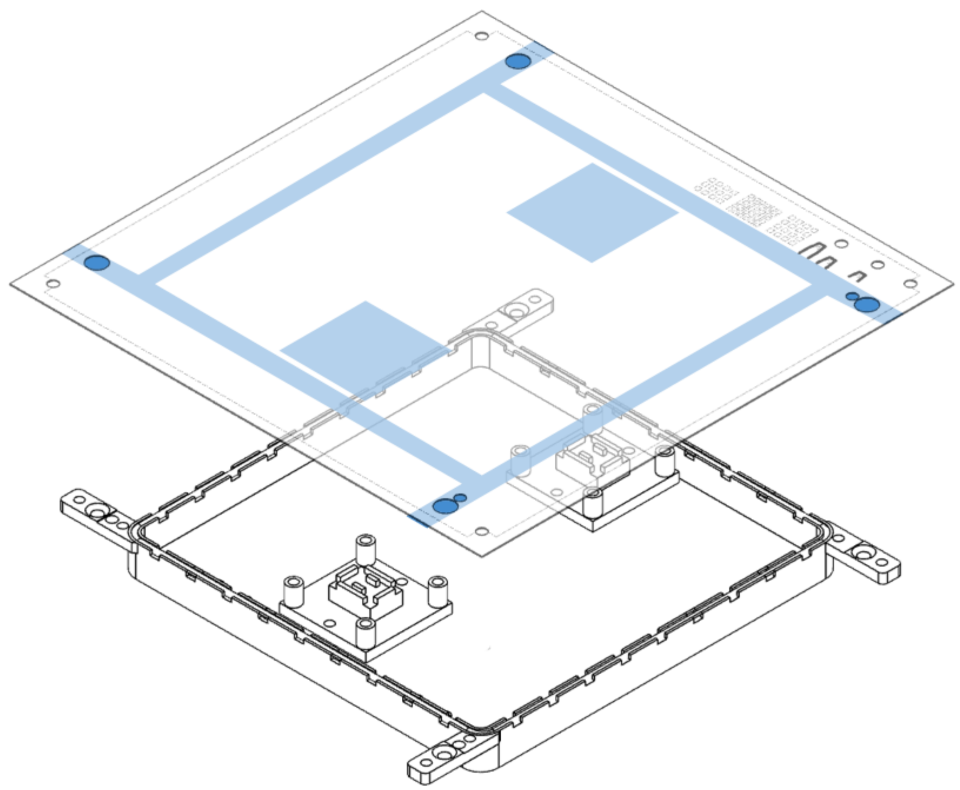


The red regions in the graphic illustrate the regions on the top or handler side of the PCB that must be kept free of components to comply with the DIB clamp and sockets. Precise dimensions depend on the type of socket and DIB clamp used.

PEDESTAL SUPPORT

The region on the bottom/fixture side of the PCB where the pedestal support and pedestals contact the board must be kept clear of surface mount components to allow the DIB Clamp to properly seat to the surface of the PCB. Signal traces that traverse across this region from the signal launch pads to the socket should include solder mask in this region to insulate the traces from the conductive elastomer and aluminum channel that contacts the PCB. As well, care should be taken to avoid the contact points of the pedestals that support the PCB socket site. Note that the geometry of this keep out region varies with the type and number of socket/pedestal sites. Reference the keep out regions illustrated in Figure 2.14.

FIGURE 2.14 PCB KEEP OUT AREAS (BOTTOM/FIXTURE SIDE)

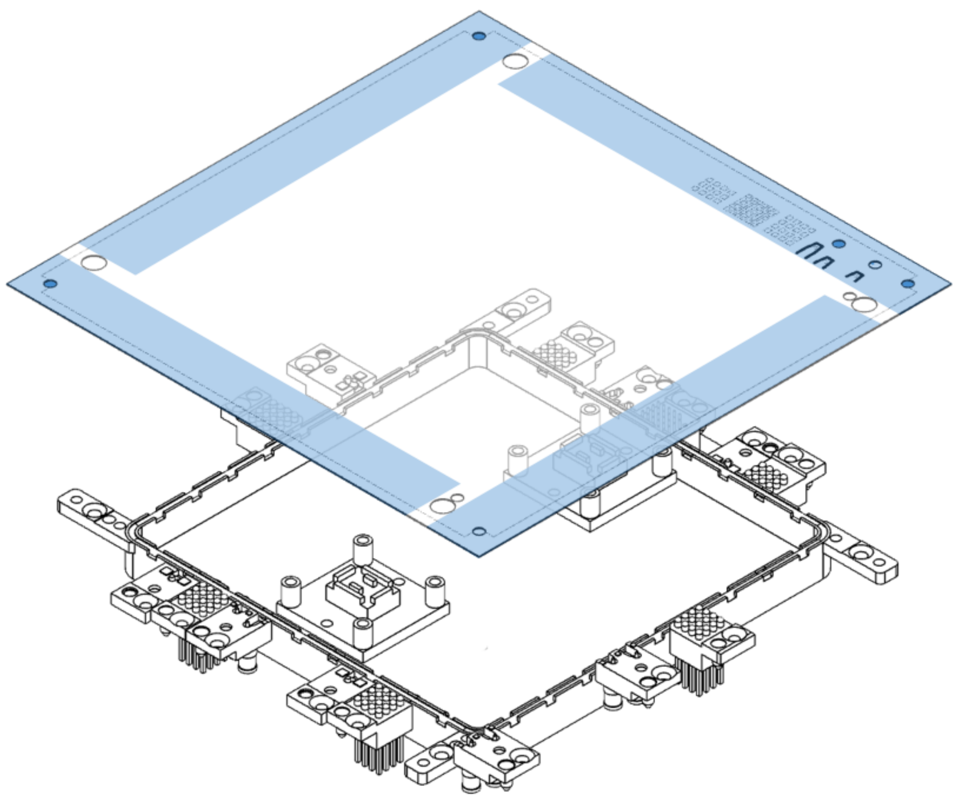


The blue region in the graphic above illustrate the region on the bottom or fixture side of the PCB that must be kept free of components to prevent interference with the pedestal support and pedestals. Note that the shape of the region may be different than the example above depending upon the type of pedestal support and pedestals.

SIGNAL LAUNCHES / SIGNAL PADS

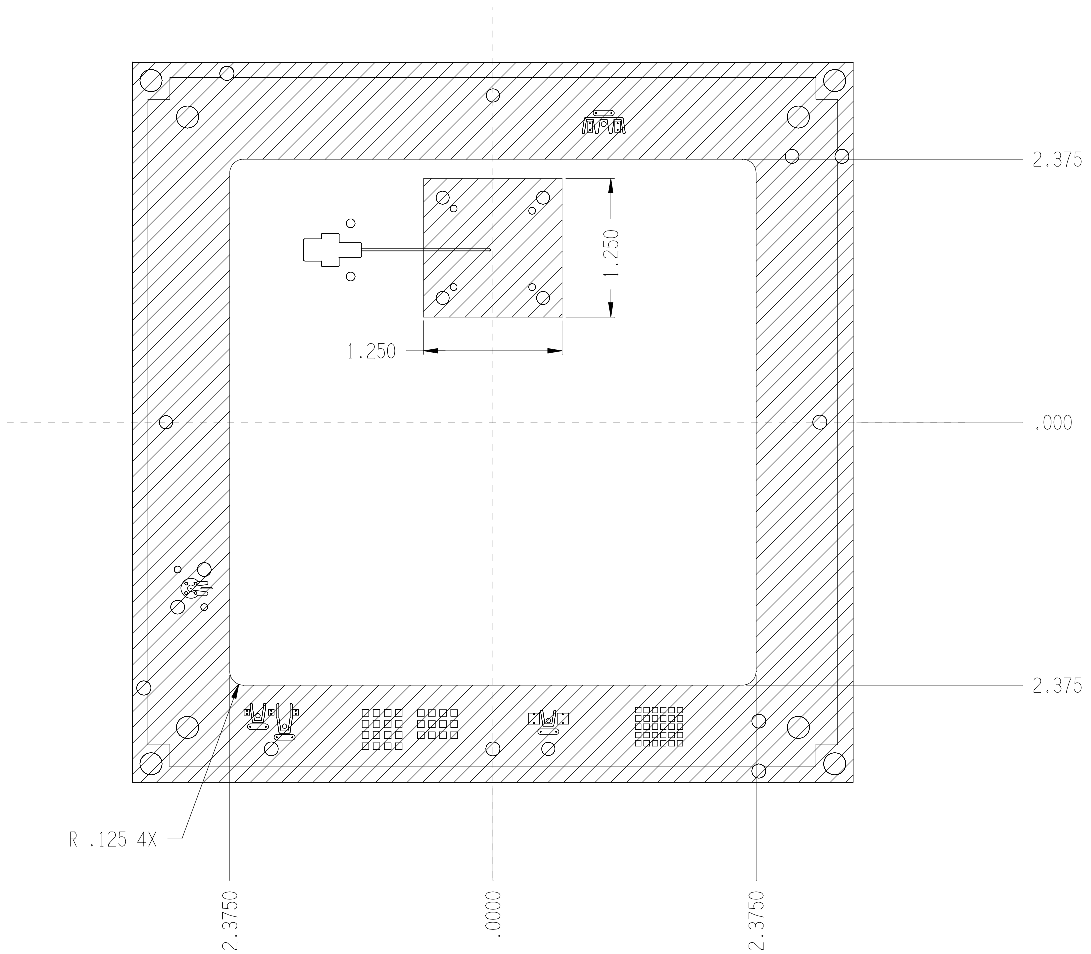
In addition to the pedestal support keep out regions, the perimeter region on the bottom/fixture side of the PCB should be kept clear of surface mount components to allow signal launches to contact properly with their corresponding signal pads on the surface of the PCB. As well, signal traces that traverse this region should be directed from their intended signal launch pads to the center region of the board with the shortest routing possible. Reference the Solder Mask section for more information on signal trace routing guidelines from signal launches/signal pads. As signal launches can be added the fixture top plate independent of the PCB design to support new features or capabilities, it is recommended to keep this region clear of unnecessary signal traces to allow forward and backward compatibility of the DIB with fixture design updates and/or revisions of signal launch layouts on the top plate. Reference the keep out regions illustrated in Figure 2.15.

FIGURE 2.15 Recommended PCB Keep Out Areas (Bottom/Fixture Side)



The blue areas in the above graphic indicate regions that are recommended to be kept free of components to prevent mechanical interference with signal launches installed in the top plate of the fixture. Areas around the perimeter of the PCB that are kept free of signal traces (except where applicable for contacting a corresponding signal pad) allow for compliance with current, or future changes/additions of signal launches in the fixture.

FIGURE 2.23 PCB KEEP OUT AREA DIMENSIONS

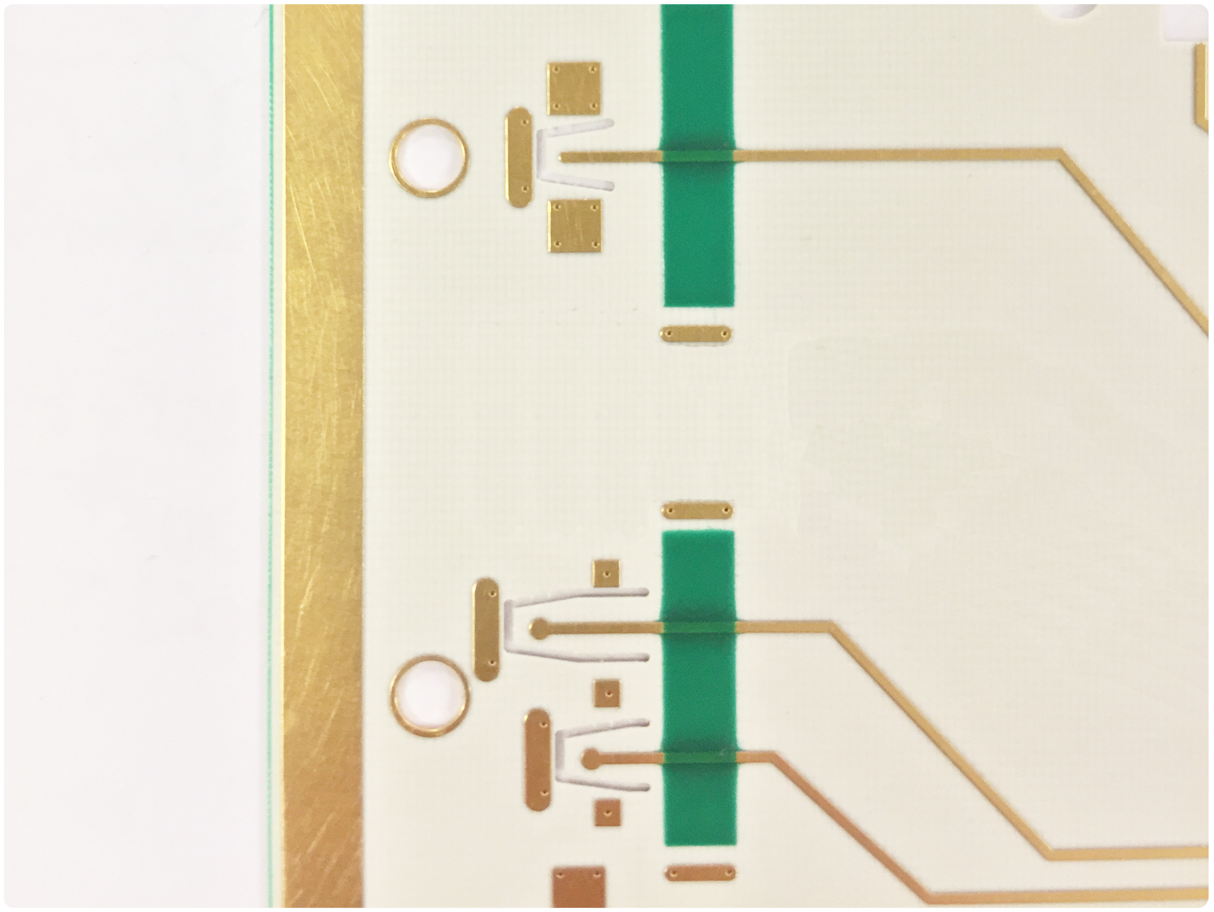


The critical dimensions of the keep out region of the device interface board are shown above. The PCB is shown from the top/handler side. The perimeter keep out region includes the pedestal support and signal launch sites on the bottom side of the PCB as well as the keep out region associated with the DIB Clamp on the top side of the board. A socket site keep out region for the top and bottom side of the PCB is provided for reference

Solder Masks

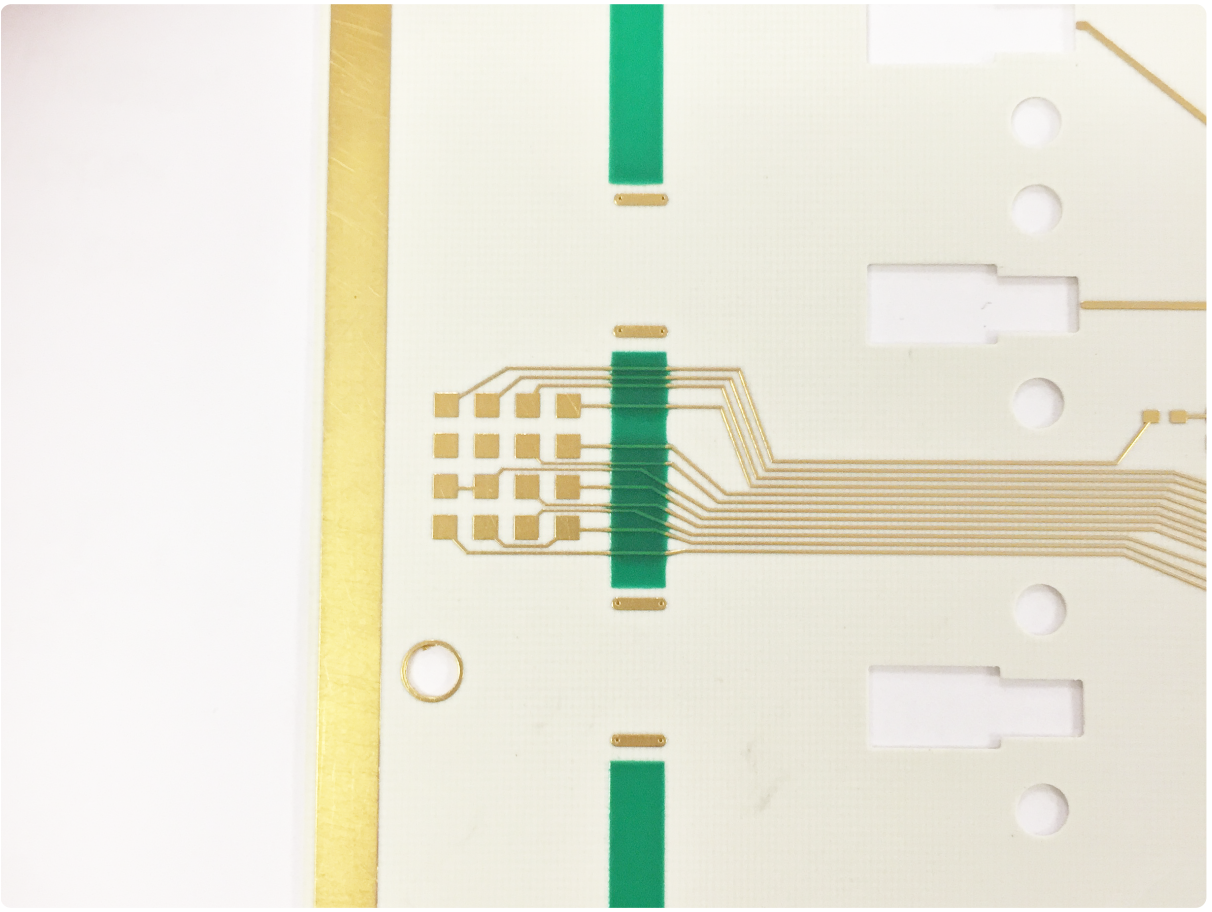
Solder masks are recommended only on the bottom/fixture side of the PCB where signal traces pass through the keep out region of the pedestal support. This region is where the conductive elastomer in the pedestal support channel contacts the underside of the DIB. As the elastomer and pedestal support are electrically grounded to the fixture body and by extension to electrical ground of the tester, a strip of solder mask is recommended to prevent the metal trace from being electrically shorted to the elastomer/ground. The width and length of the solder mask can be varied depending on the signal pad, signal launch layout, trace requirements, and pedestal support type. Standard practice is to set the width of the solder mask to correspond with the width of the signal launch in the top plate and the length of the solder mask to extend at minimum to the boundaries of the elastomer diameter and/or the pedestal elastomer channel. The dimensions of the launches and pedestal support types can be referenced in the Mechanical Specifications section. Reference Figure 2.10 for the elastomer's and/or elastomer channel diameter in the pedestal support. It should be noted that small regions of the elastomer near signal launches can be cut and removed to aid in the clearance of signal traces, but the solder mask ensures compatibility with the pedestal support.

FIGURE 2.16 Solder Mask Example with RF Traces



The above picture shows two different types of RF signal launch pads on the underside of the DIB. The solder masks cover the traces in the region where the pedestal support contacts the board preventing accidental electrical shorting of the traces to ground. At the edges of the solder mask are grounded metal pads that contact the elastomer in the pedestal channel helping to enhance RF shielding and isolate the traces from any stray signal effects or cross talk from launches adjacent to the DC traces when the pedestal is installed.

FIGURE 2.17 Solder Mask Example with DC Traces



The above picture shows a single DC signal launch pad on the underside of the DIB. The solder masks cover the traces in the region where the pedestal support contacts the board preventing accidental electrical shorting of the traces to ground. At the edges of the solder mask are grounded metal pads that contact the elastomer in the pedestal channel helping to isolate the traces from any stray signal effects or cross talk from launches adjacent to the DC traces when the pedestal is installed.

Ground Plane

A solid ground plane on the top/handler side is the general recommendation for all PCBs. This provides the ideal environment for micro-strip signal traces in RF and microwave applications. As well, this large metal surface provides an ideal structure for dissipating heat buildup during test as well as providing a suitable heat sink for maintaining thermal consistency from run to run during device testing. Reference the PCB Specifications for metal thickness.

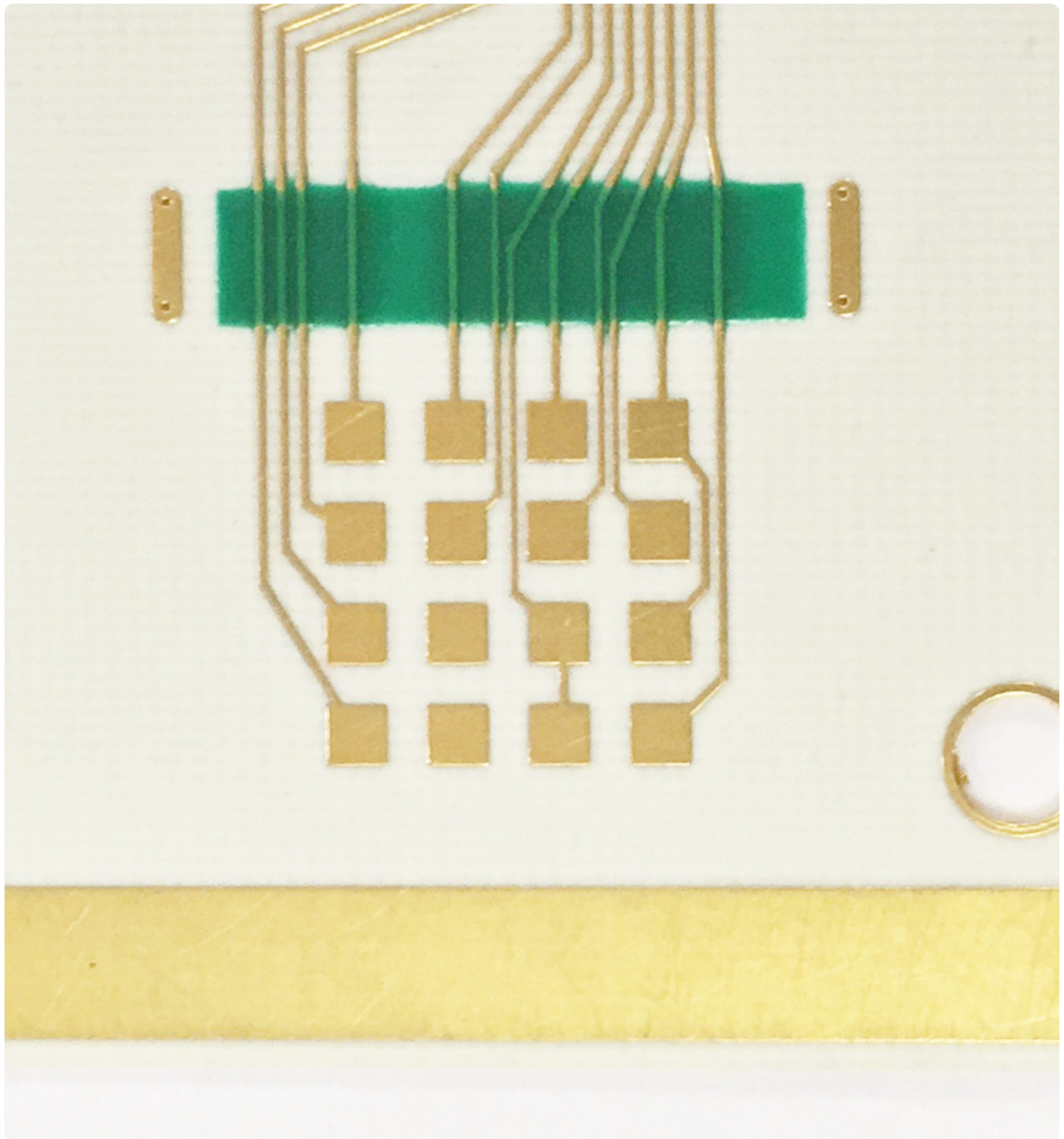
Signal Launch Pads

This section provides the pad layouts, geometry and spacing to comply with the standard set of DC, digital, RF, and microwave signal launch types currently available. Signal pads provide a contact point on the surface of the DIB to transition the test resources and/or test signals from the signal launches on the top plate of the fixture to the device interface PCB. On the DIB, the signal pads are placed on the bottom/fixture side of the PCB around the perimeter of the board to correspond to the location of signal launches on the top plate. The top plate and signal launches adhere to a standard form factor and pitch spacing to maintain signal layout consistency across the various types of DC, digital, RF, and microwave launch types. When installed properly, the signal launches provide the appropriate mechanical tolerance for consistent pressure contact with the PCB, ensuring proper electrical performance.

PCB FOOTPRINTS

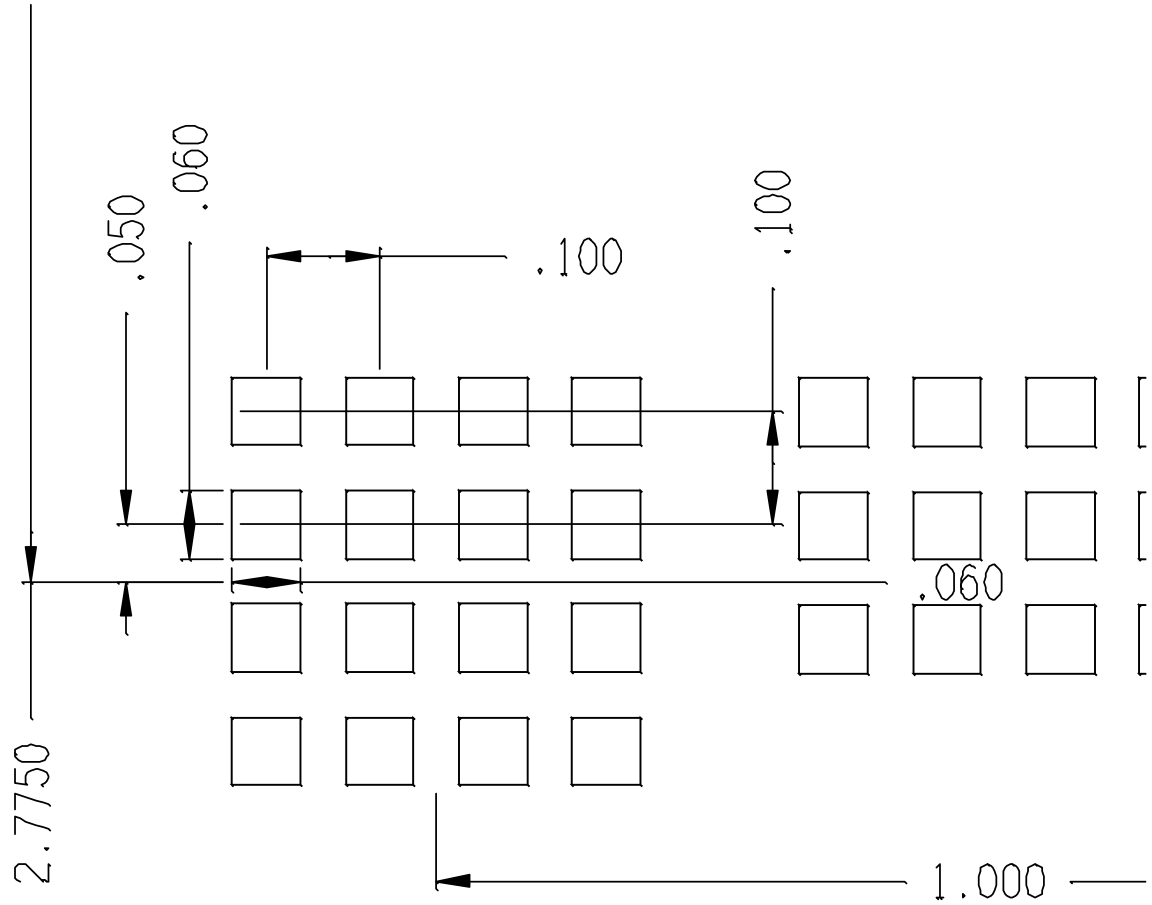
The following pages contain examples of the different PCB launch pad footprints and mechanical dimensions. The center of the footprint is referenced to the center line of the PCB denoted by the “B” lines in Figure 2.12. This x-y dimension provides the spacing information of the footprint on a sample PCB. Each launch can be placed around the perimeter of the PCB using a standard 0.5 inch pitch(1.0 inch pitch for digital launch/footprint) placement from the center of the footprint. The PCB center lines can be referenced in Figure 2.12 in the Mechanical Specifications sections.

FIGURE 2.29 DC PCB Footprint Example



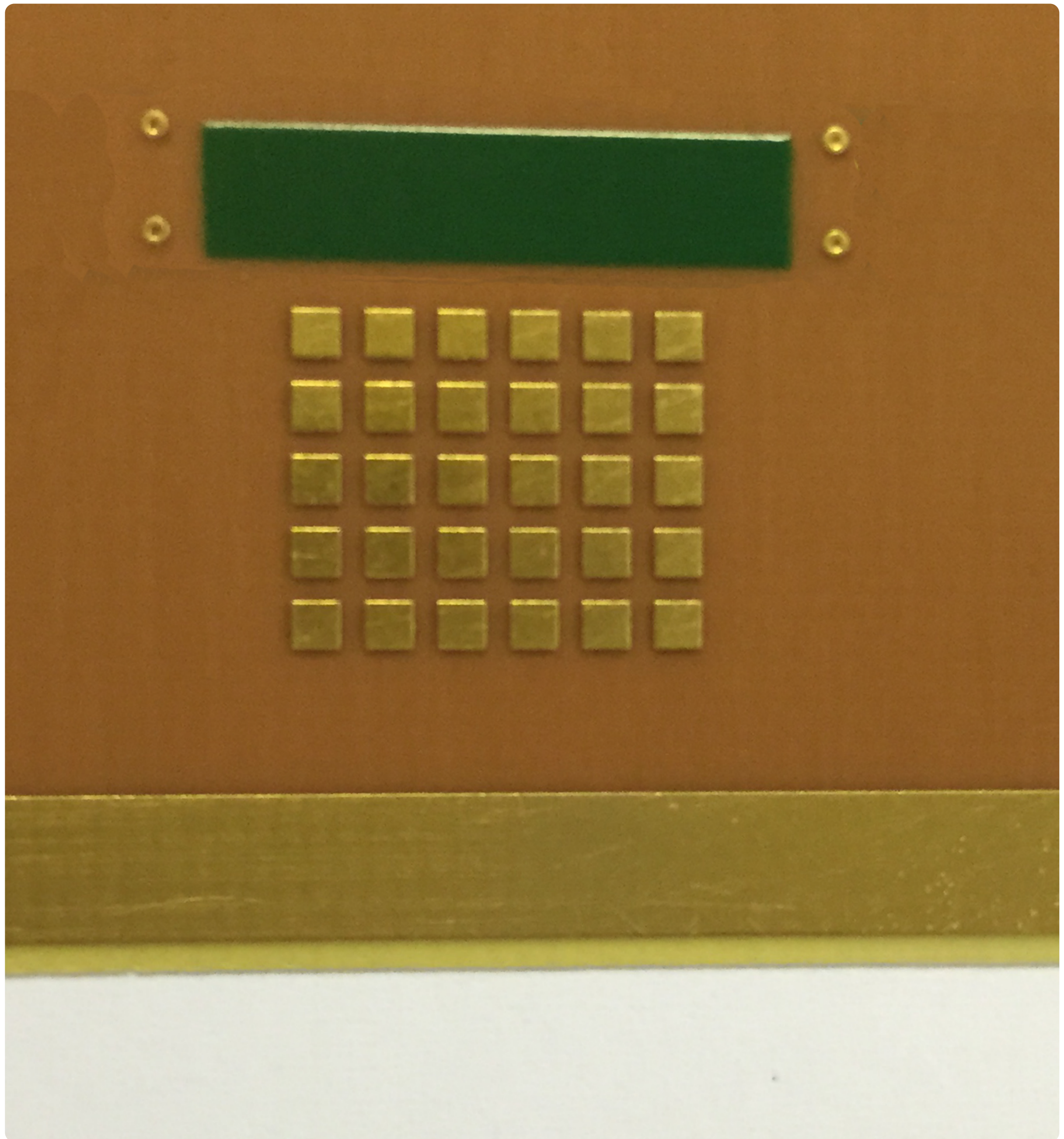
The picture shows a single DC pad on the underside of the DIB with signal traces routing to the socket location in the center of the PCB.

FIGURE 2.28 DC PCB Footprint Dimensions



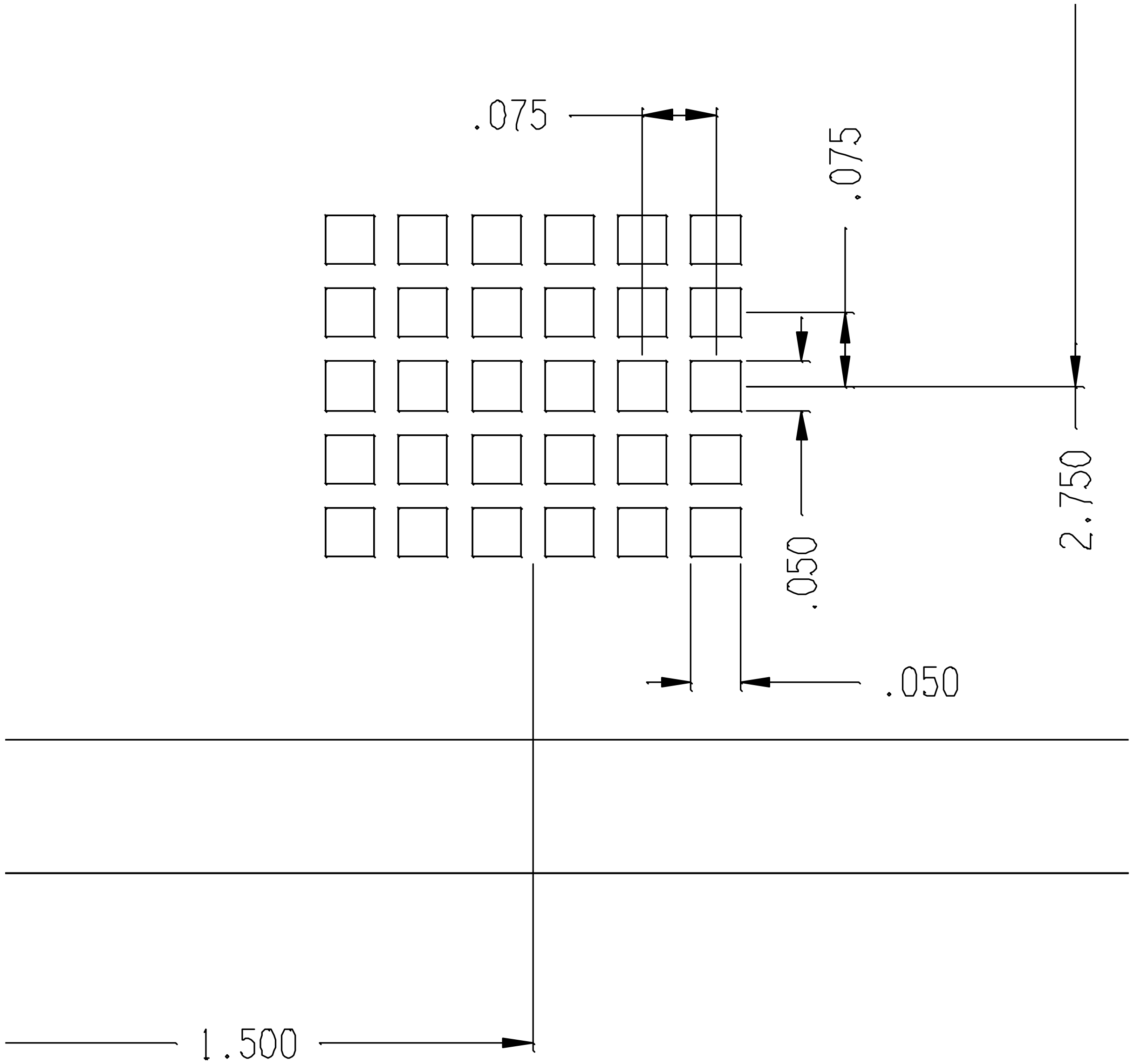
The drawing above shows the feature dimensions as seen from the top/handler side, through the PCB. The 2.775 and 1.000 dimensions denote a reference distance from the footprint center to the PCB center line for placement along the perimeter of the PCB.

FIGURE 2.27 Digital PCB Footprint Example



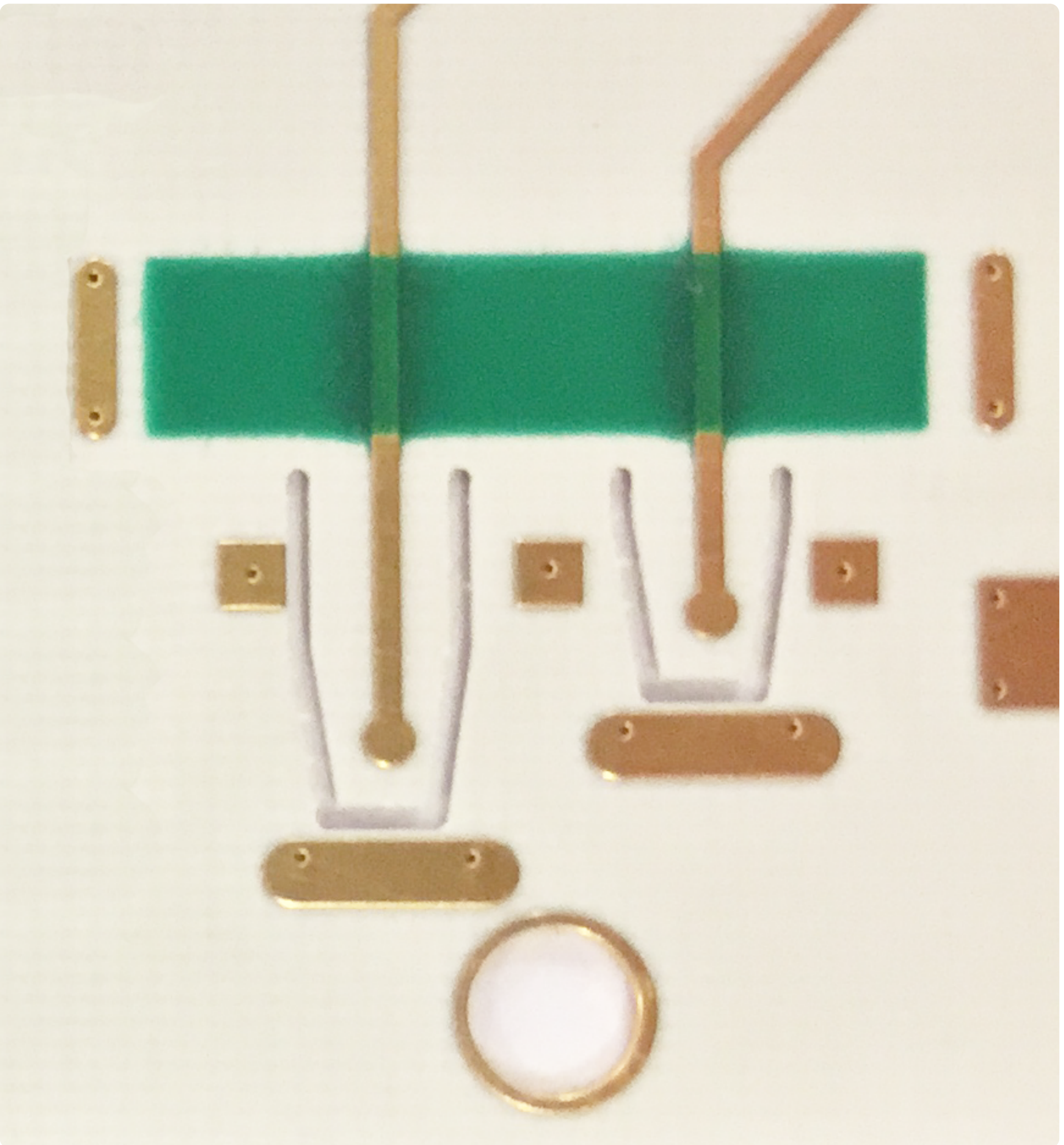
The picture shows a digital pad on the underside of the DIB.

FIGURE 2.26 Digital PCB Footprint Dimensions



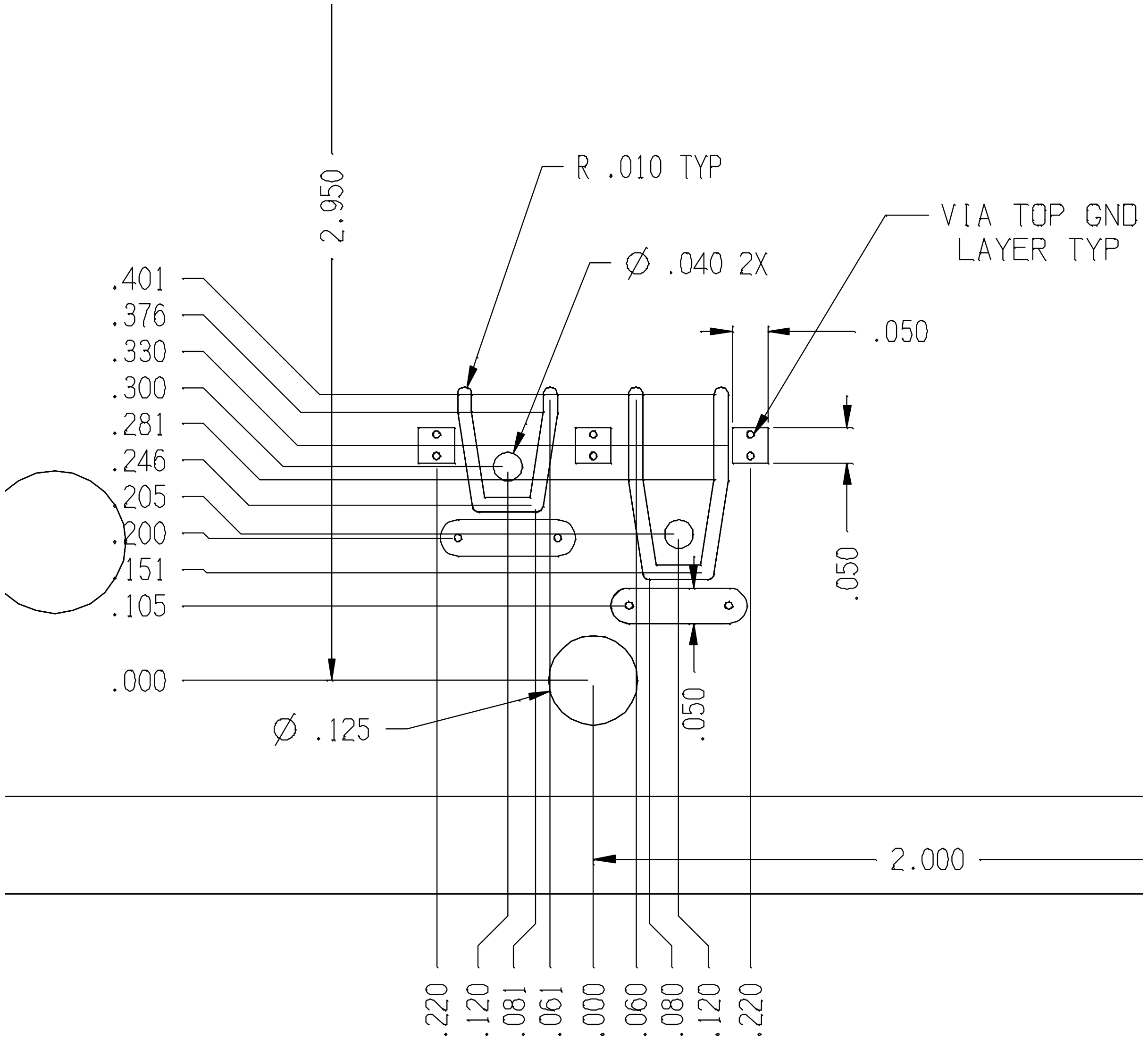
The drawing above shows the feature dimensions as seen from the top/handler side, through the PCB. The 2.750 and 1.500 dimensions denote a reference distance from the footprint center to the PCB center line for placement along the perimeter of the PCB.

FIGURE 2.18 Dual MCX RF PCB Footprint Example



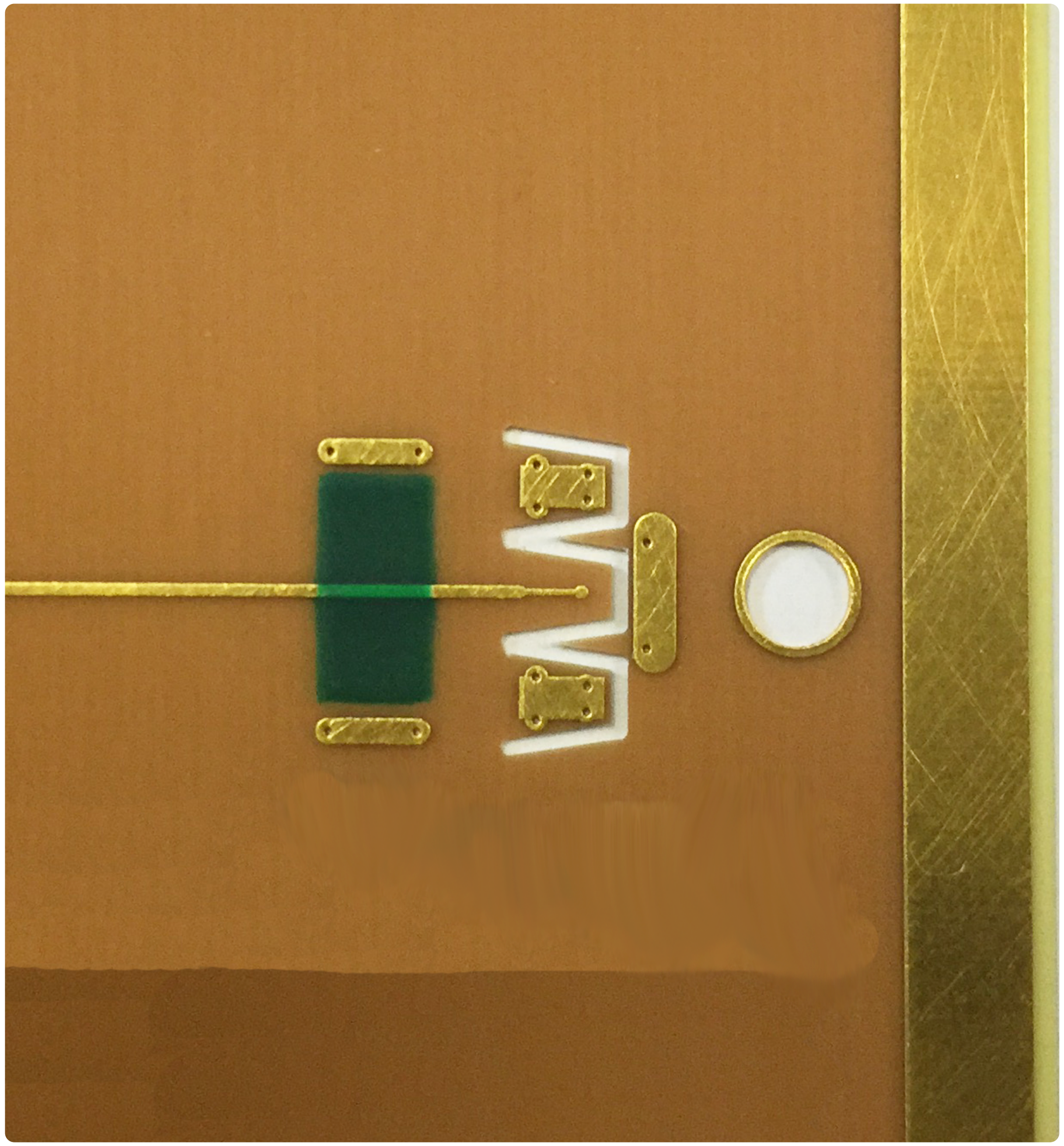
The image above shows the footprint and board etching pattern for the Dual MCX RF signal launch pad as seen from the bottom/fixture side.

FIGURE 2.19 Dual MCX RF PCB Footprint Dimensions



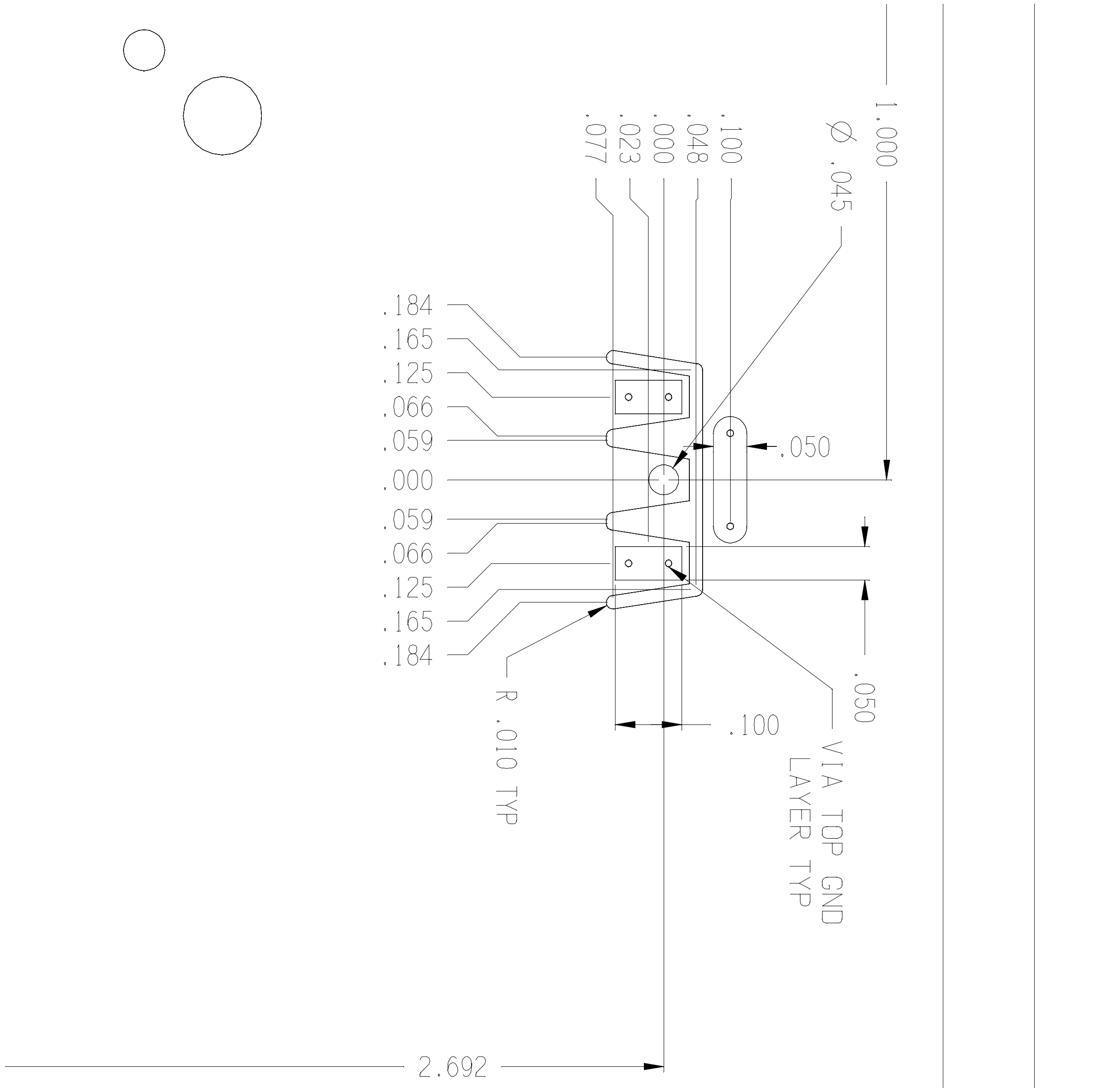
The drawing above shows the feature dimensions as seen from the top/handler side, through the PCB. The 2.950 and 2.000 dimensions denote a reference distance from the footprint center to the PCB center line for placement along the perimeter of the PCB.

FIGURE 2.20 SMA RF PCB Footprint Example



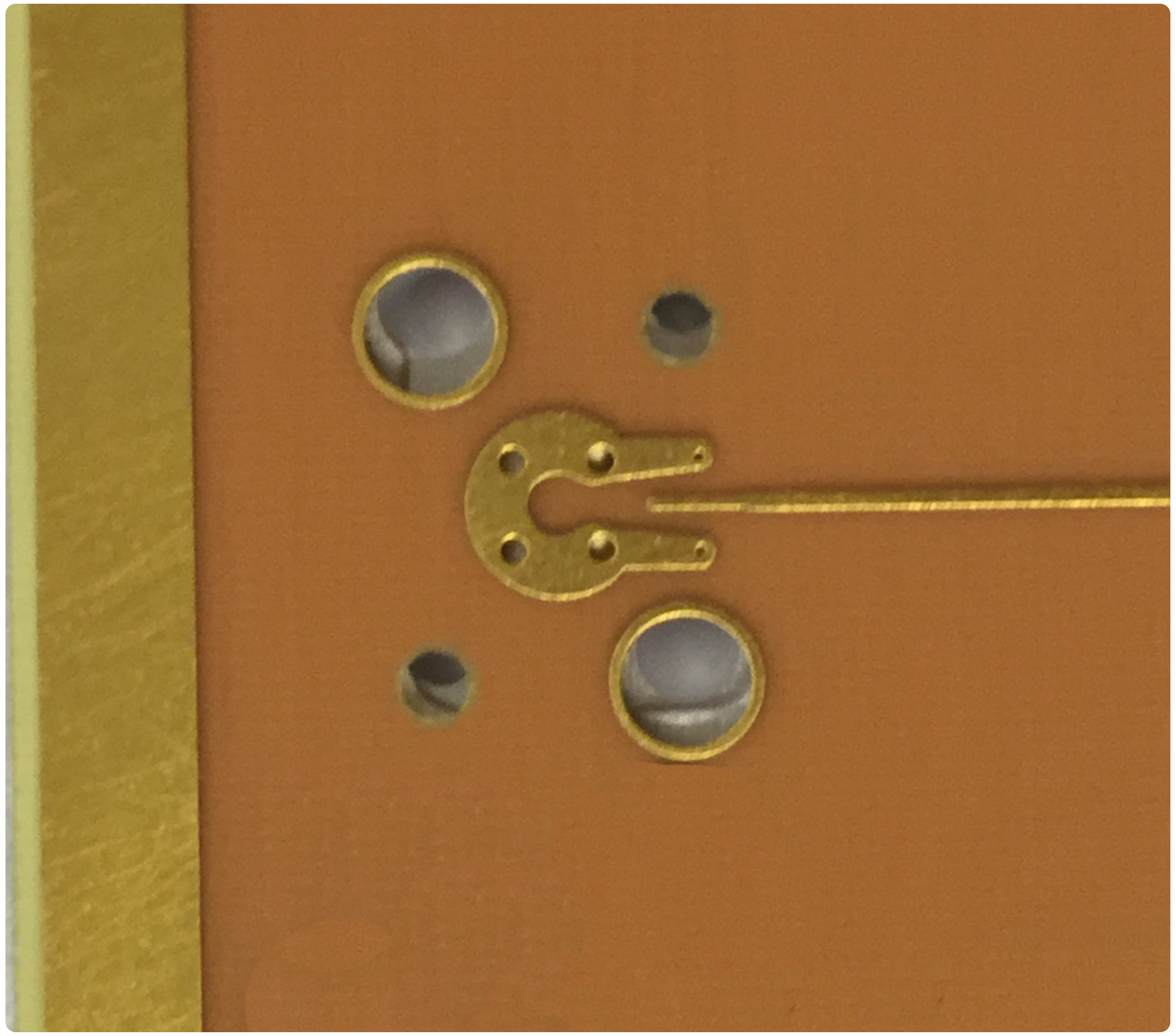
The image above shows the footprint and board etching pattern for the SMA RF signal launch pad as seen from the bottom/fixture side.

FIGURE 2.21 SMA RF PCB Footprint Dimensions



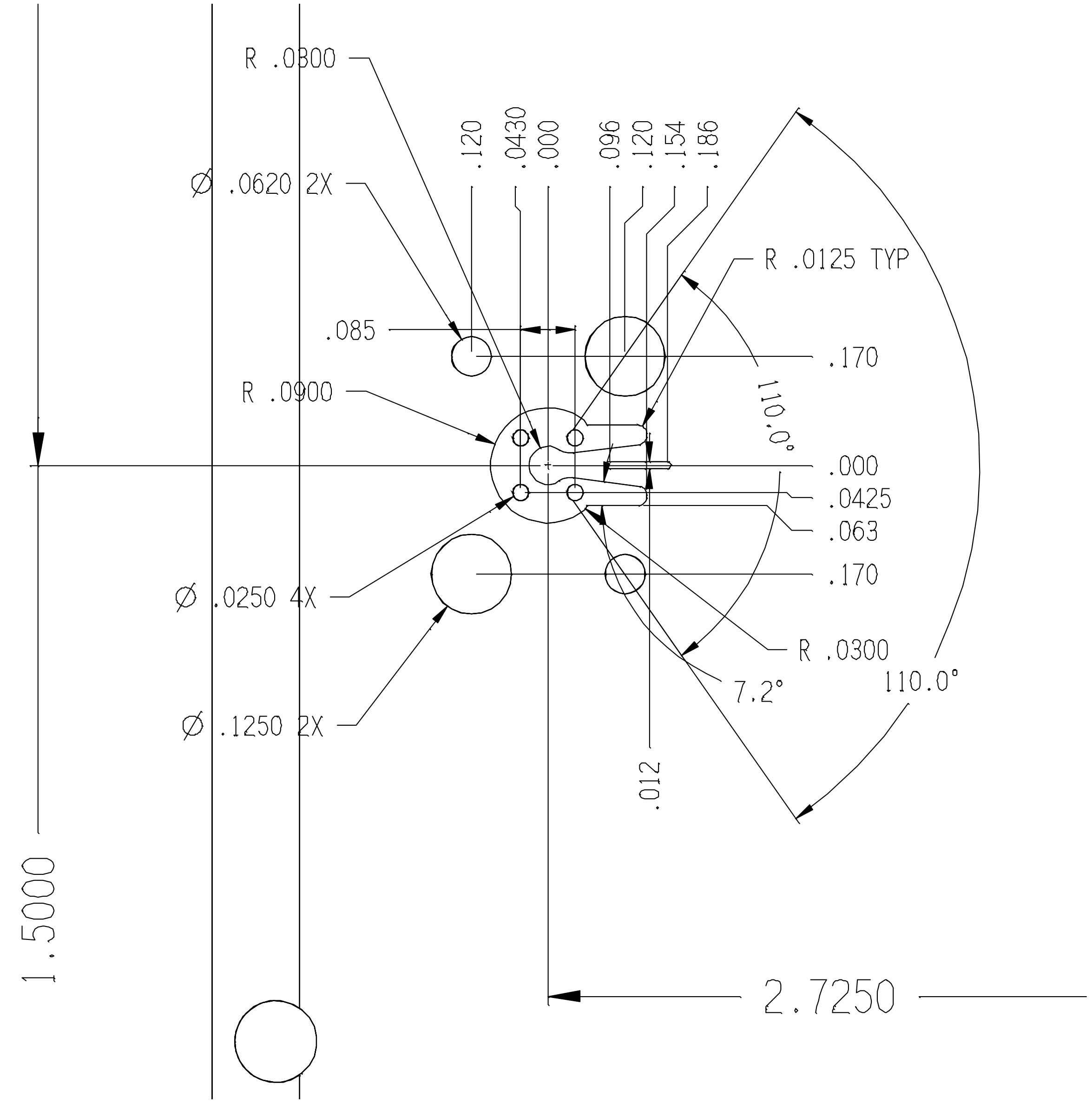
The drawing above shows the feature dimensions as seen from the top/handler side, through the PCB. The 2.692 and 1.000 dimensions denote a reference distance from the footprint center to the PCB center line for placement along the perimeter of the PCB.

FIGURE 2.24 SSMP PCB Footprint Dimensions



The picture shows a SSMP launch footprint on the underside of the DIB with a signal trace routing to the socket location in the center of the PCB. The lack of solder mask in the example above requires the conductive elastomer in the pedestal support to be cut away in this region to prevent shorting the trace to the pedestal and effectively ground.

FIGURE 2.25 SSMP PCB Footprint Dimensions



The drawing above shows the feature dimensions as seen from the top/handler side, through the PCB. The 2.7250 and 1.500 dimensions denote a reference distance from the footprint center to the PCB center line for placement along the perimeter of the PCB.

INTERCONNECT & APPLICATION LAYER

3

The Interconnect and Application Layer provides information about:

- Top Plate
- PCB Signal Launch Types & Layout Options

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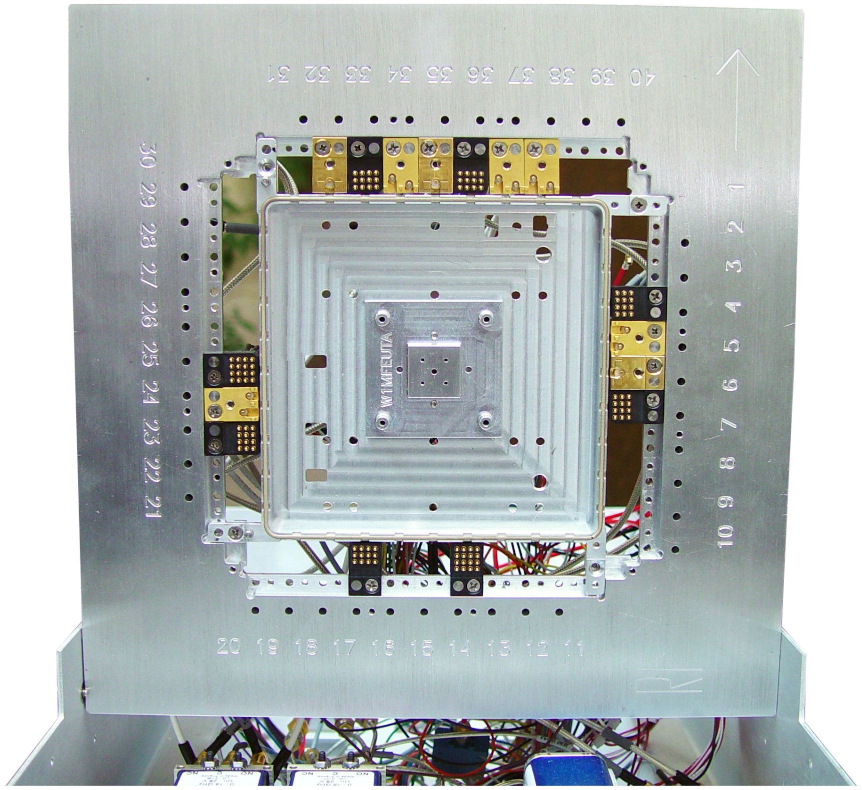
Top Plate

The top plate is an aluminum cover plate that sits within the upper opening of a Cassini fixture, see Figure 3.1. It is equipped with tapped screw holes along the perimeter edge of the plate to secure it to the fixture body as well as alignment and screw hole along the inner perimeter of the plate to install signal launches. The signal launch alignment and screw holes use standard spacing and sizes to allow universal support for any launch in any position. The locations are also indicated with a location designation number etched into the top plate for referencing the location.

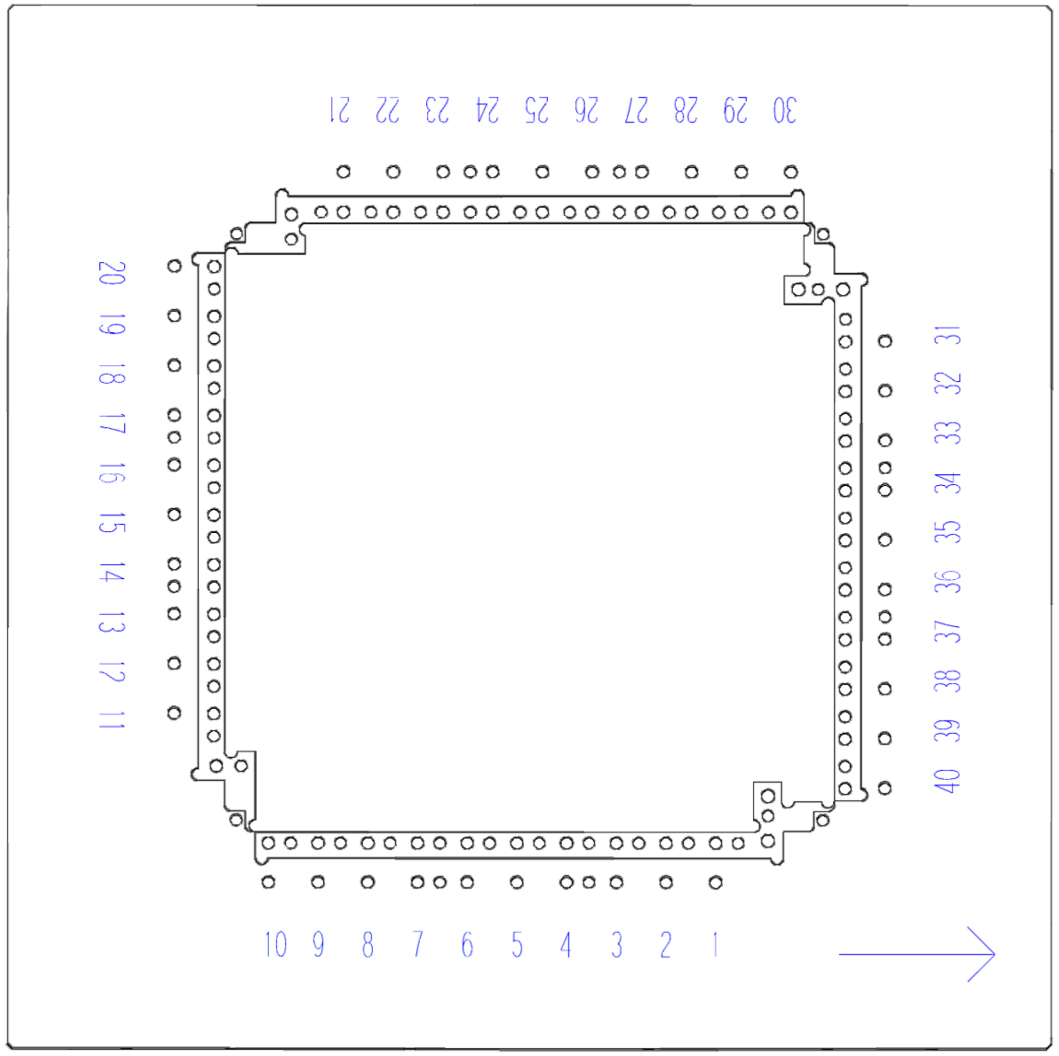
The plate is secured to the top of the fixture with 12 screws as shown in Figure 3.3. When removed and the screws in the positions highlighted in Figure 3.4 are loosened, the top plate can be hinged open to allow access to the interior of the fixture.

FIGURE 3.1 Top Plate Example



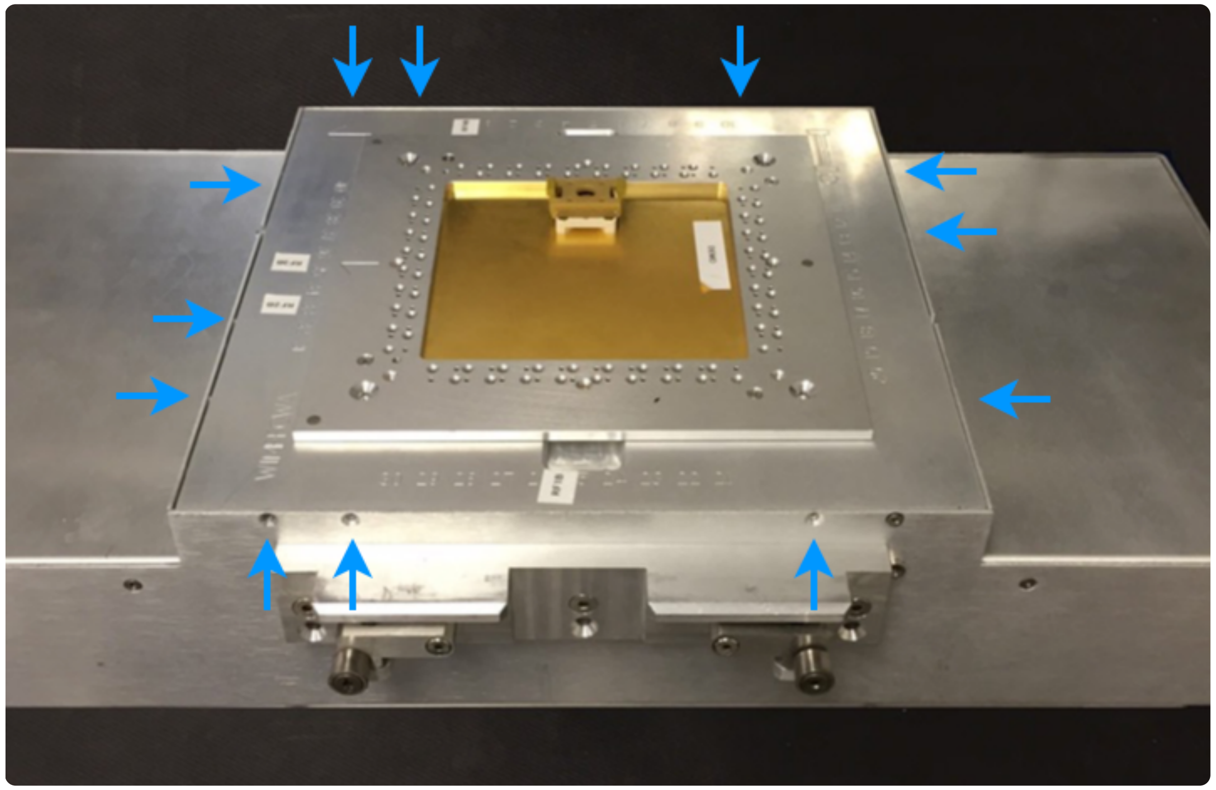
The picture above shows an example of a top plate with signal launch inserts and pedestal support installed. The plate is in the hinged, open position on the fixture to allow access to signal resources during development.

FIGURE 3.2 Top Plate Designators



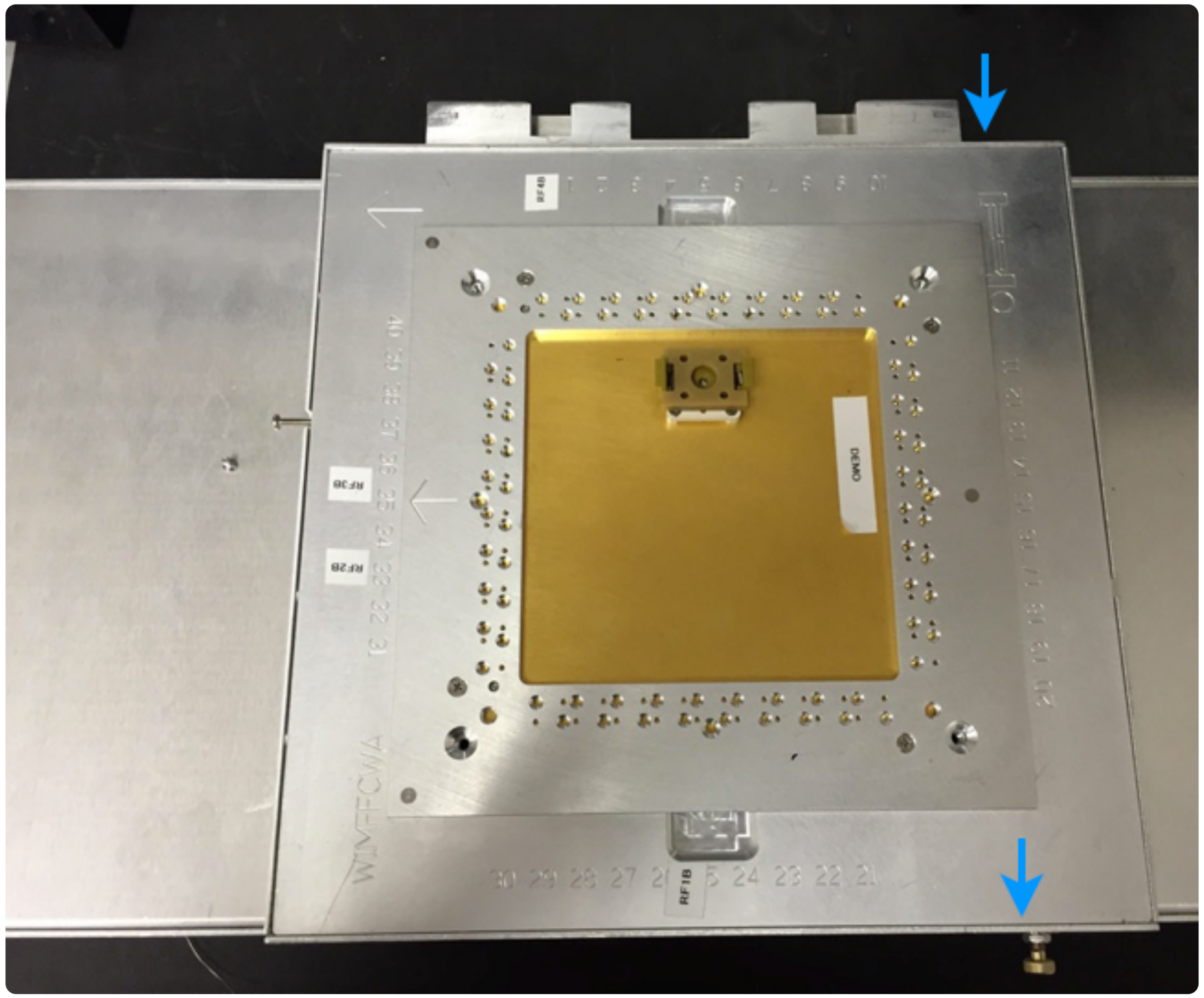
The number designators for signal launch insert positions in the top plate are shown in blue around the inner perimeter of the top plate. The orientation arrow(bottom right) indicates the location of the tester to assist in correctly positioning the fixture on the Cassini test head.

FIGURE 3.3 Installing the Top Plate



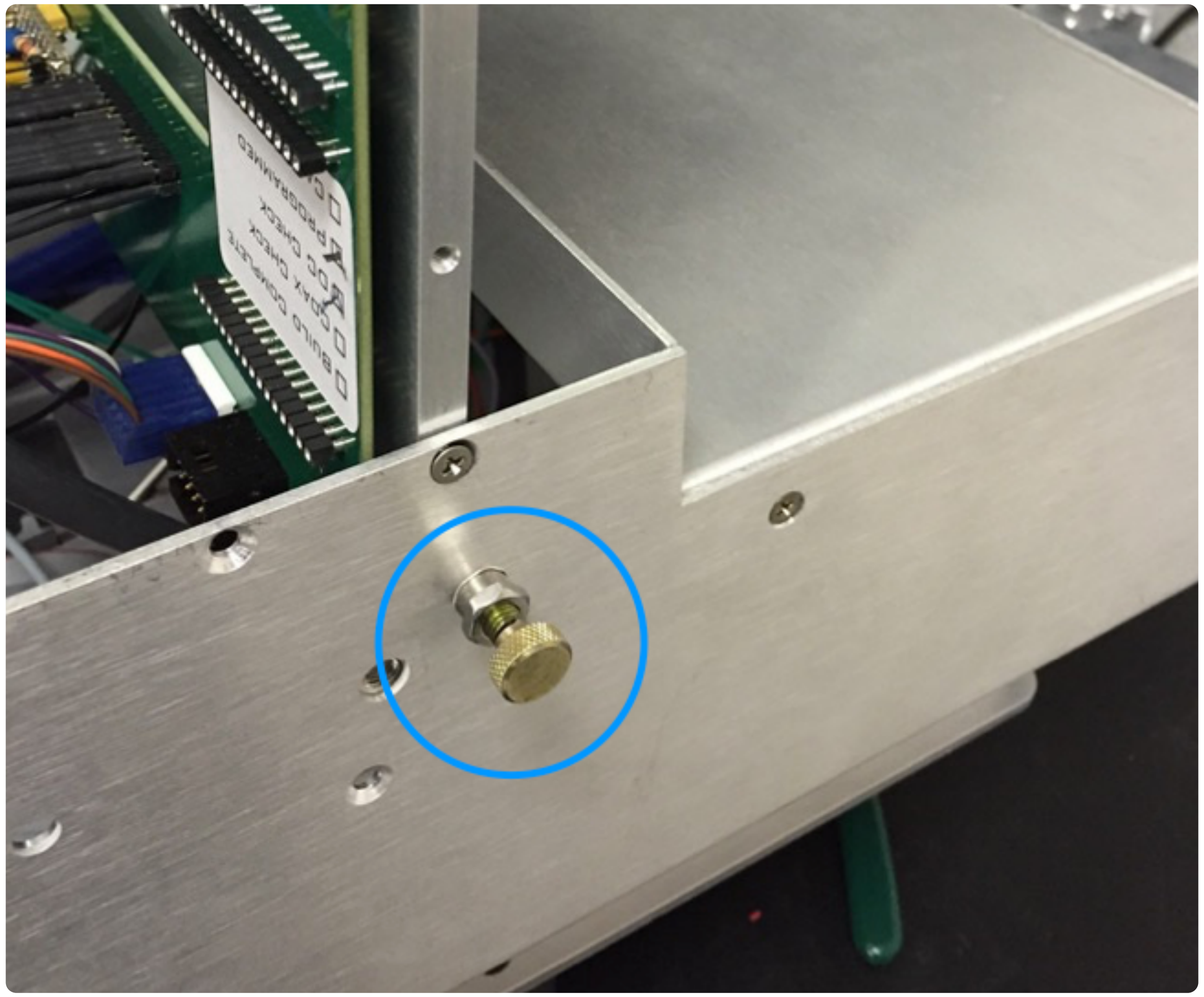
The blue arrows indicate the location of the top plate securing screws. These hold the top plate firmly in place.

FIGURE 3.4 Top Plate Hinge screws



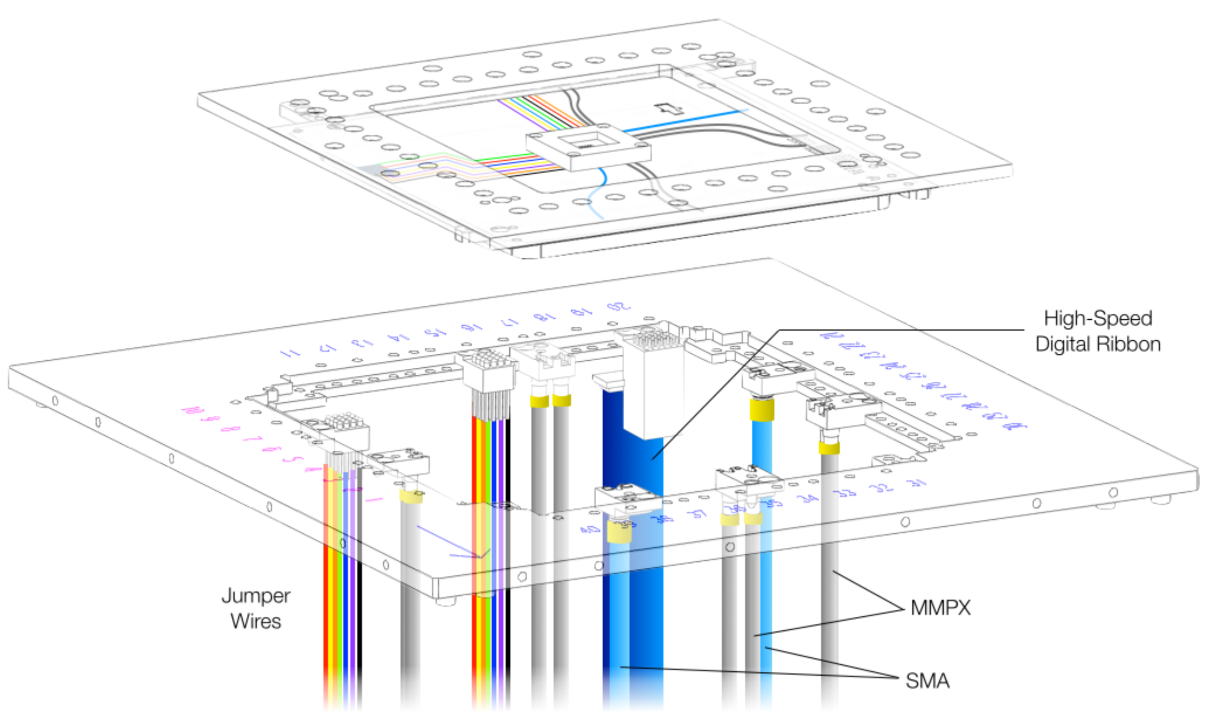
The blue dots indicate the location of the hinge screws. Removing the securing screws and loosening the two screws above, located nearest to the locking pin side, allow the top plate to hinge open for access to resource interconnect and fixture modules.

FIGURE 3.5 Top Plate Hinge Locking Pin



The locking pin shown above allows the top plate to be held in the open position by pulling the tab away from the fixture body, hinging the top plate past the tab, and then releasing the tab to lock in place. If a fixture is not equipped with a locking tab, the fixture should be placed on its side to prevent the top plate from accidental closure.

FIGURE 3.6 TOP PLATE, SIGNAL LAUNCHES, & DIB

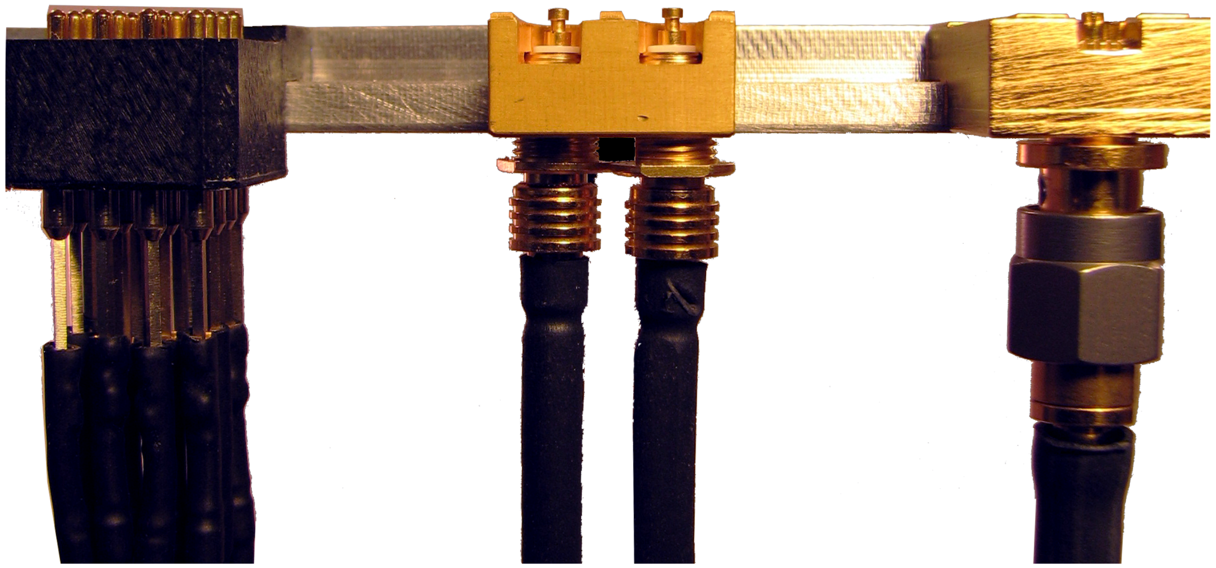


The top plate with signal launch inserts installed and connected to various resources via standard DC, digital, and RF cables are shown in relation to the DIB.

Signal Launch Inserts

This section provides descriptions and performance specifications for the various DC, digital, RF, and microwave signal launch inserts available for Cassini fixtures. Signal launch inserts are precision machined connectors designed to contact the underside of the DIB and transition the test resources and/or test signals from the fixture to the device interface PCB. The inserts have a standard form factor that complies with universal insert locations along the fixture top plate perimeter and/or top plate center bar. This allows the signal launch inserts to be configured to a designer's application. Each insert has a guide pin and threaded screw that correspond to pre-defined positions along the top plate. When installed properly, the signal launches provide the appropriate mechanical tolerance for consistent pressure contact with the PCB, ensuring proper electrical performance.

FIGURE 3.7 Signal Launch Insert Examples

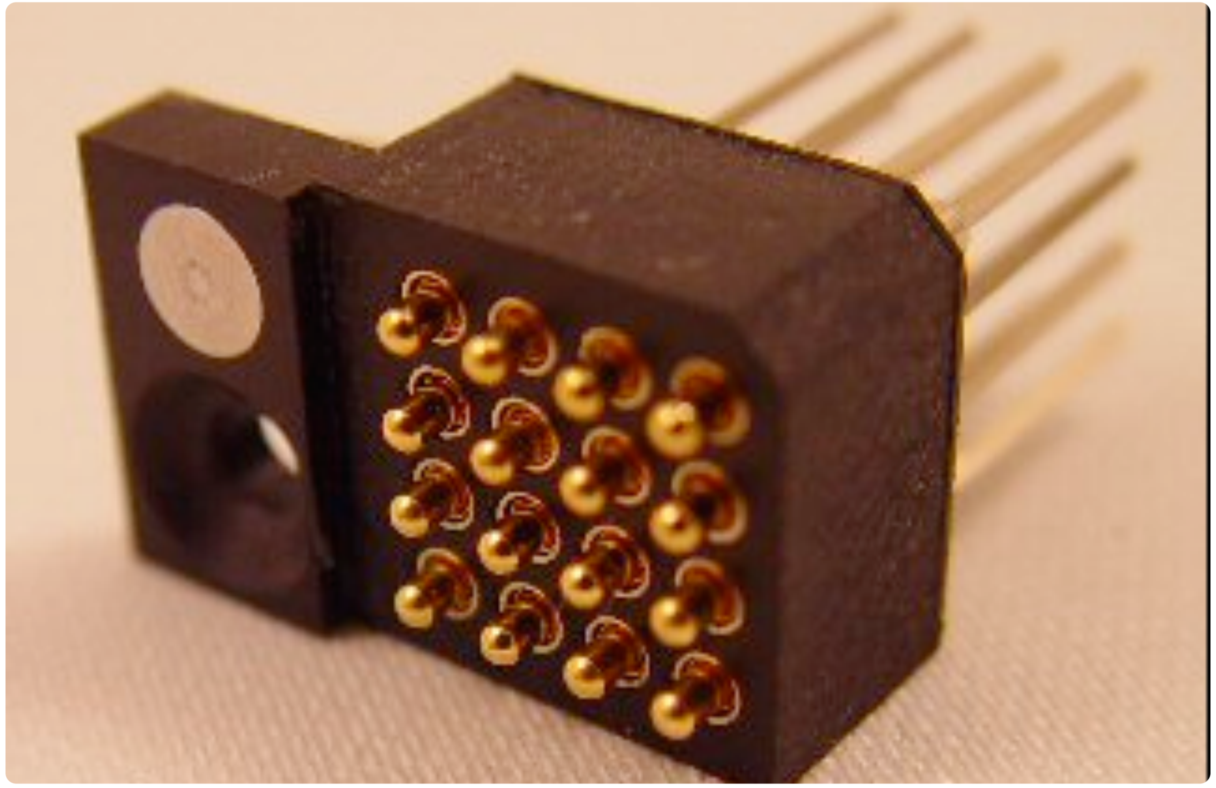


Side view of a DC(left), Dual RF with MCX type connector(center), and single RF with SMA(right) signal launches.

DIRECT CURRENT (DC)

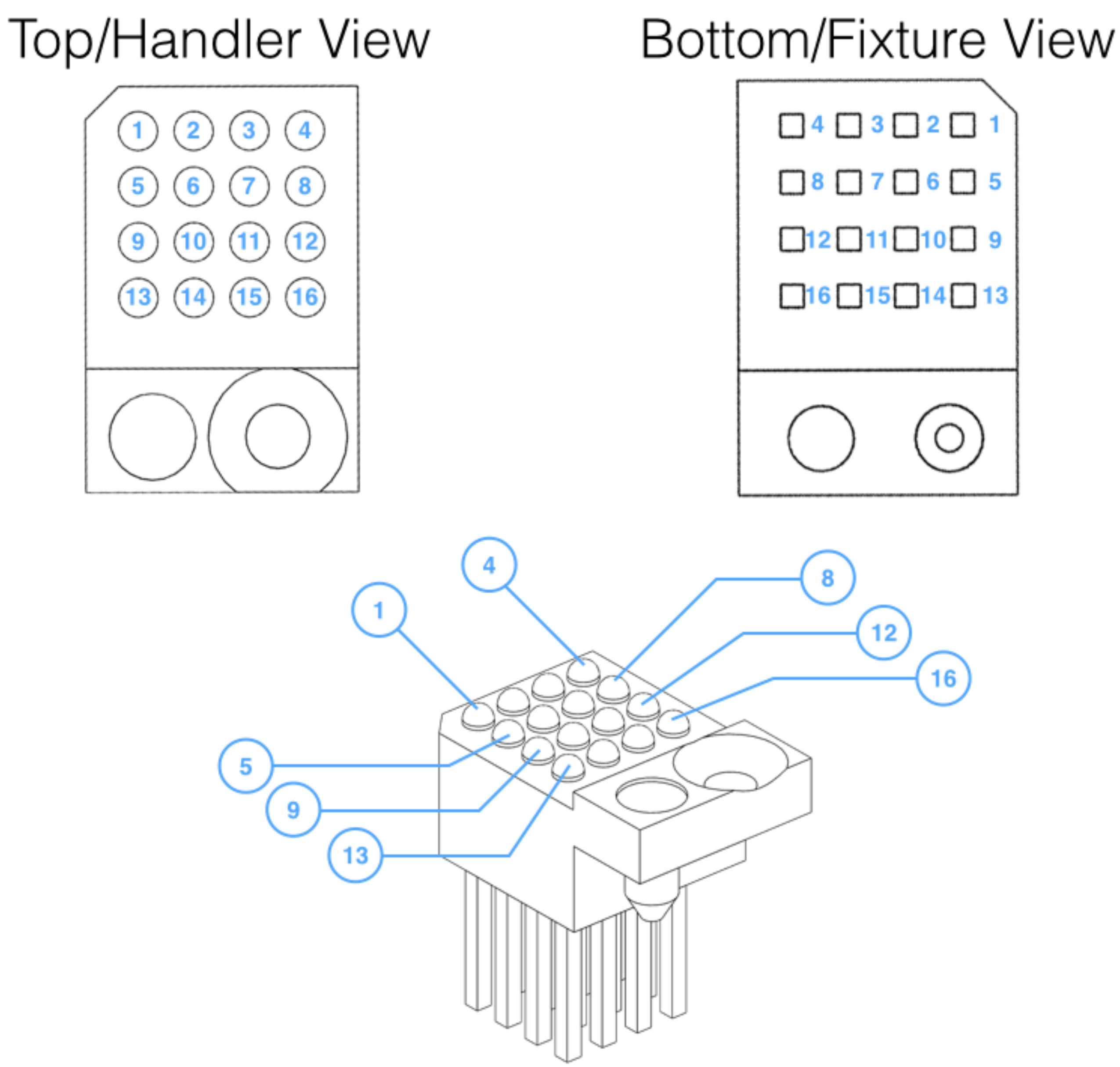
The RIK0135 launch is used to route DC resources to the DIB. The insert provides 16 pogo pin contacts to connect with the PCB signal pads via a pressure contact. Resources from the fixture are routed using standard, 28-gauge jumper wires. Jumper wires can be installed in any position on the insert. Each pin and pogo can support up to 200V and 5A of current.The insert contains an alignment pin and countersunk screw hole for securing the insert to the top plate in any available position along the top plate.

FIGURE 3.8 DC LAUNCH INSERT



The DC insert provides 16 pogo pin contacts that can be connected to standard 28-gauge jumper wires within the fixture. The notch along the polymer body(upper right corner of picture) denotes pin 1.

FIGURE 3.9 DC LAUNCH INSERT PINOUT



DC signal Launch pinout diagram

DIGITAL

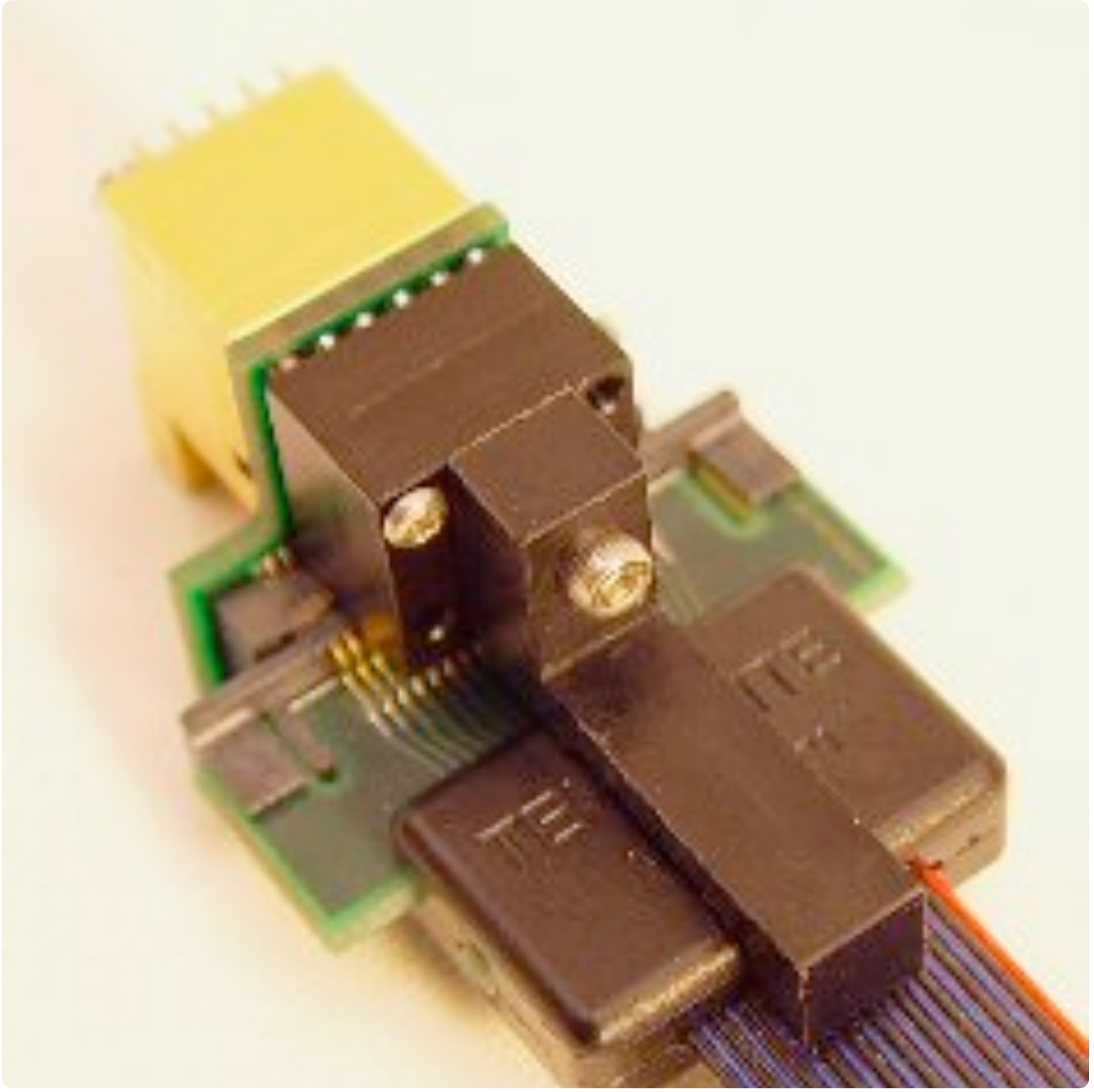
The RIK0137 launch is used to route high-speed digital pin resources to the DIB.

The insert provides 20 pogo-pin contacts to connect with the PCB signal pads via a pressure contact. Resources from the fixture are routed to the launch using a high-density, ribbonized coaxial cable. The cable connector is secured to the launch insert with a locking tab. Each launch and cable combination can support digital signaling up to 20 Gbits and individual pins support serial signaling up 100 MHz. The insert contains an alignment pin and countersunk screw hole for securing the insert to the top plate.

The location of the digital signal launch should take into account the length of the cable when routing from the bottom plate TIM interface block to the signal launch insert. This distance should not exceed the length of the ribbon cable(12" or 305mm) when the fixture top plate is in the closed or open/hinged positions. The top plate launch insert positions that are ideally suited for this constraint are locations 8-23. Reference Figure 3.2 for the top plate launch positions.

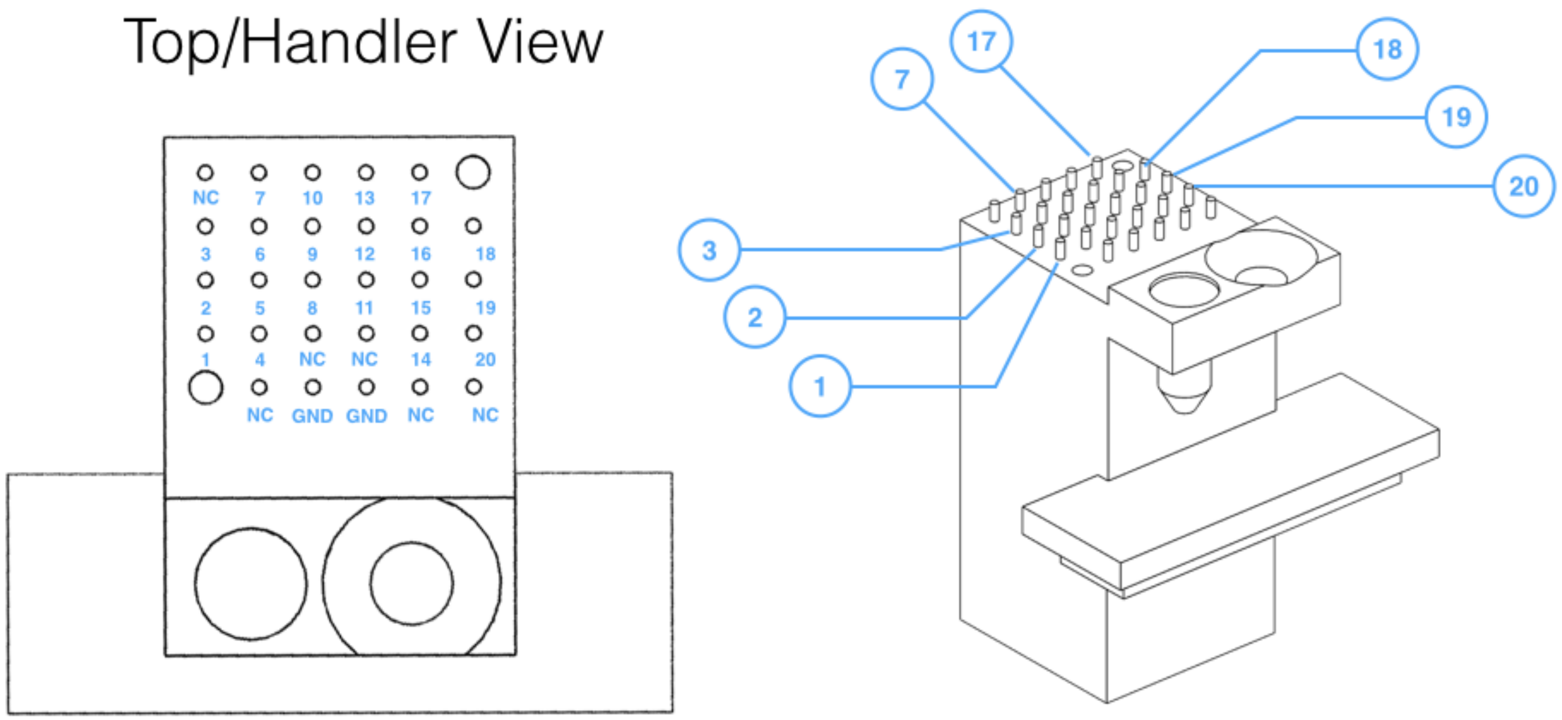
NOTE: Multiple digital launch inserts cannot be placed adjacent to one another on the top plate due to the width limitations of the ribbon connector.

FIGURE 3.10 DIGITAL LAUNCH INSERT



The high-speed digital launch accommodates a coaxial ribbon cable that carries 20 digital signals to the 20 pogo pins on the launch insert.

FIGURE 3.11 DIGITAL LAUNCH INSERT PINOUT

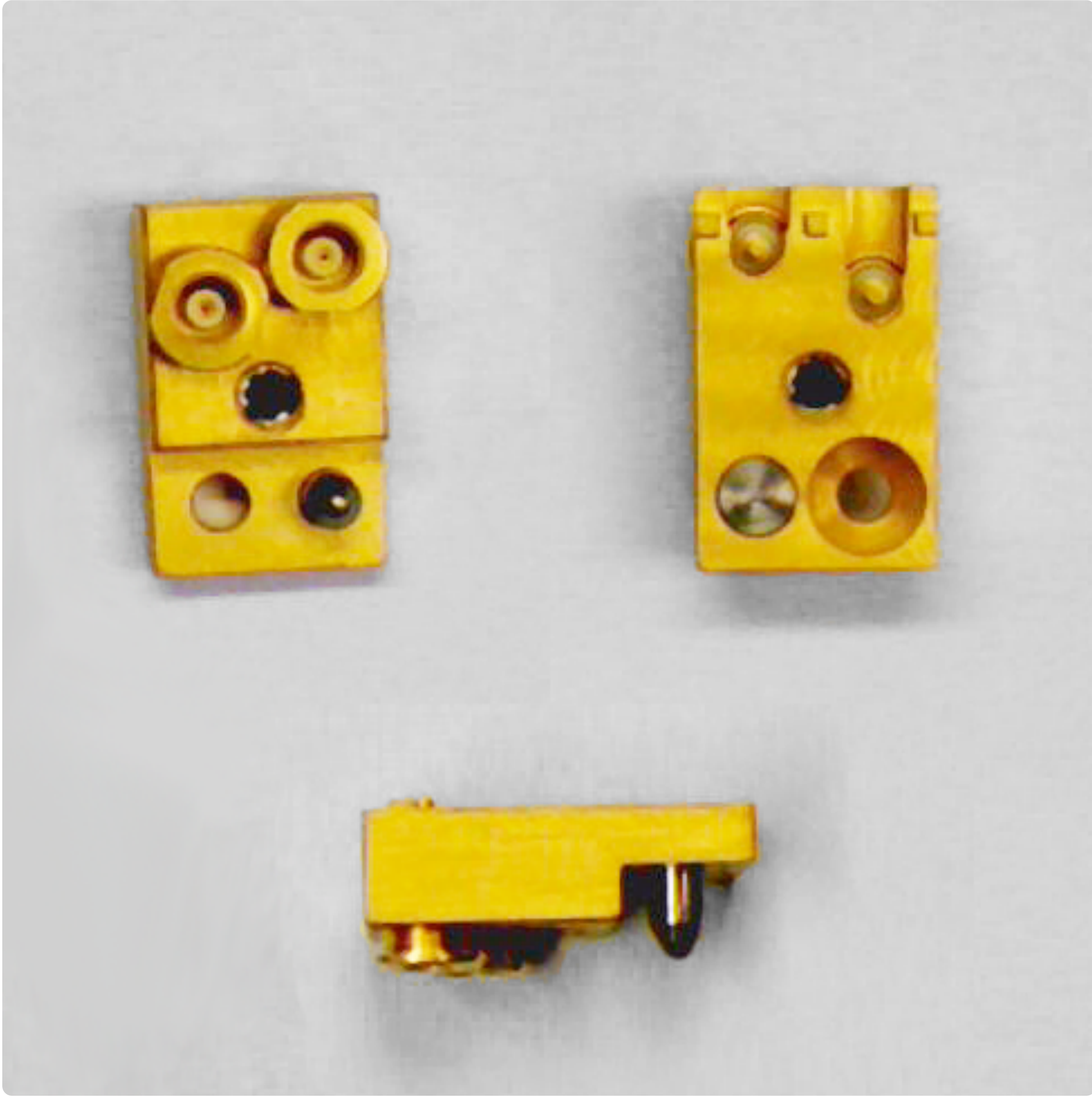


High-Speed Digital signal Launch pinout diagram

RF (DC TO 6GHZ):

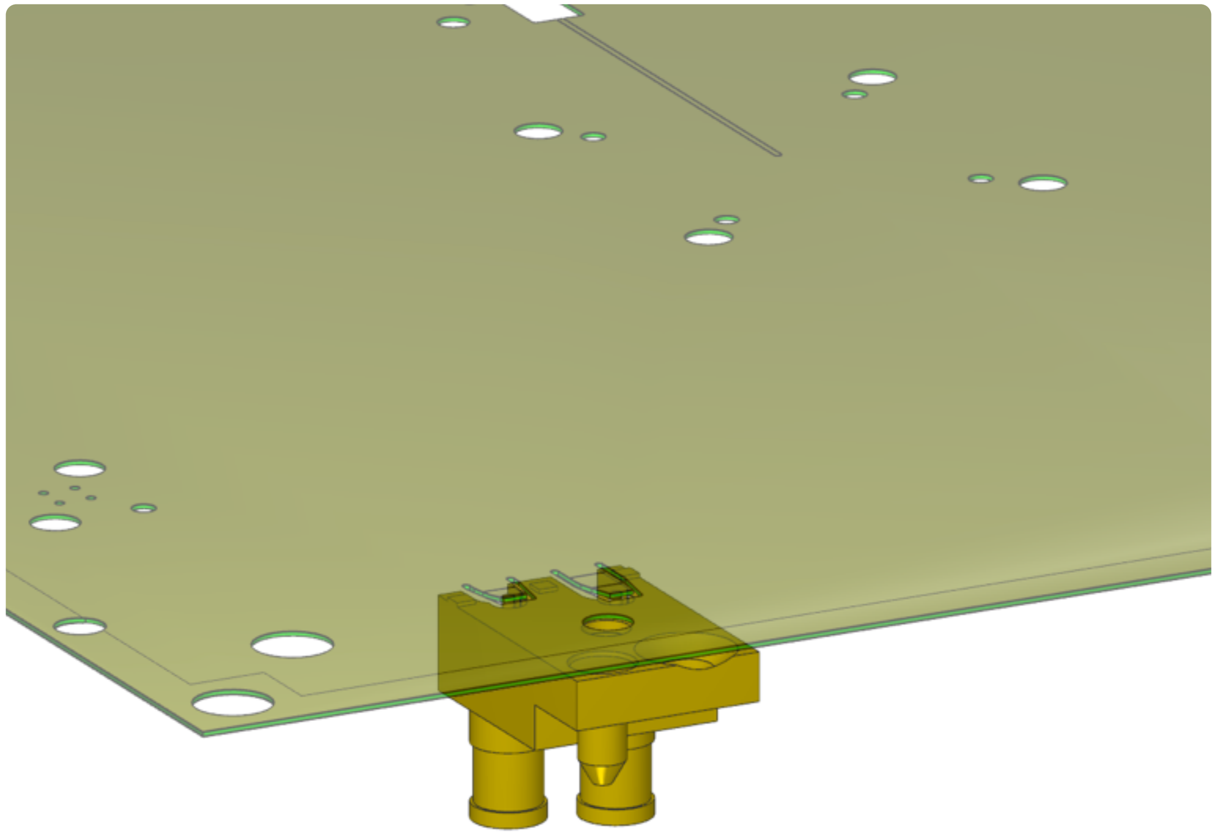
The RIK0138 dual MCX launch is used to route two RF signals or (differential pair) up to 6GHz onto a DIB. The insert provides two MCX female connectors for standard RF cable interfacing inside the fixture. These signals map to precision height launch pins that make pressure contact with the PCB via a tab design. Tabs etched onto the launch near the center conductor provide enhanced impedance matching. This launch does not require any snap-on or twist-type connection between the PCB and the launch, making it compatible with Quick-Lock DIB systems.

FIGURE 3.12 DUAL MCX RF LAUNCH INSERT

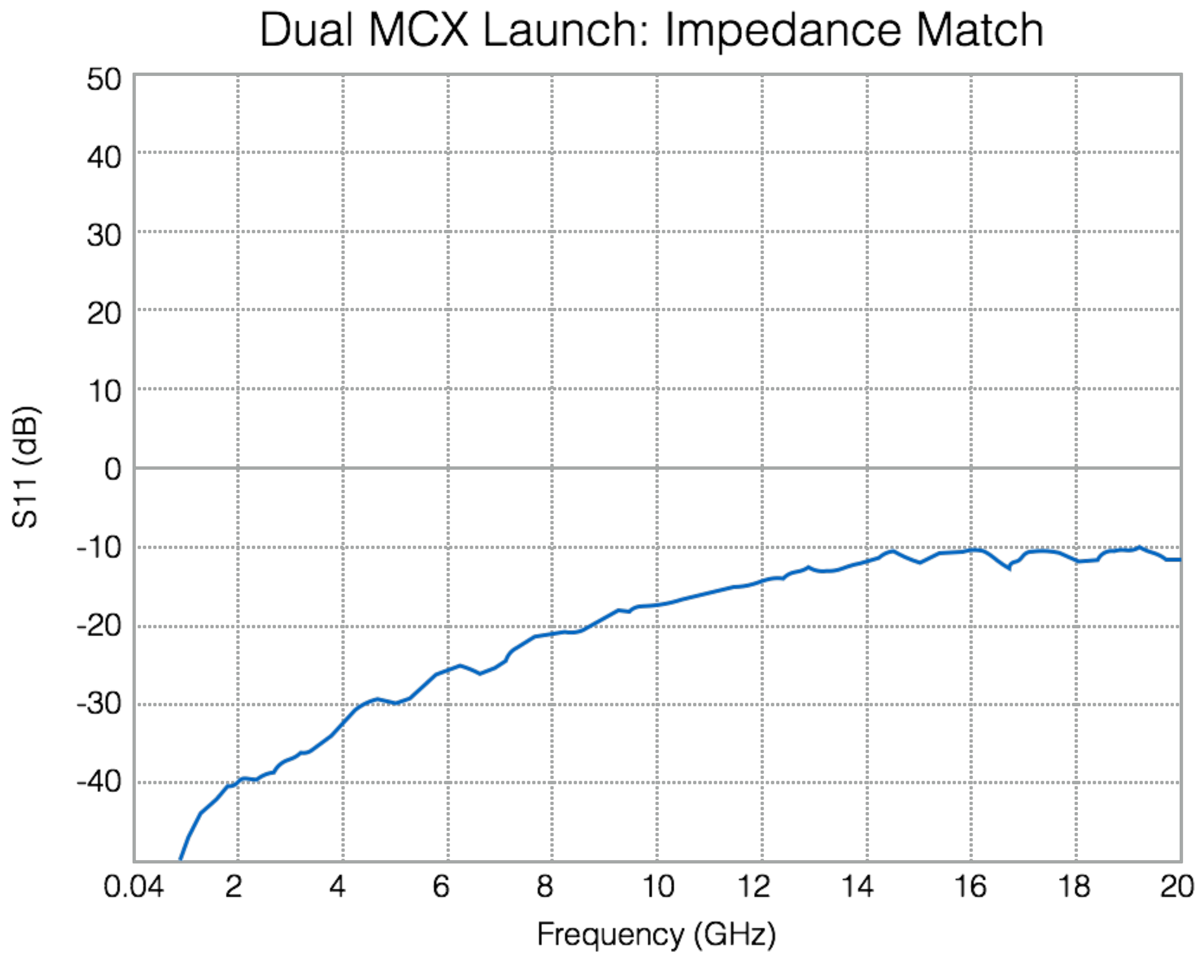


The image above shows the Dual RF launch insert from three different angles. The launch connects to MCX-adapted RF cables from the fixture.

FIGURE 3.13 DUAL MCX RF LAUNCH CONTACTING PCB



The illustration above shows the Dual RF launch insert relative to the PCB. The signal tabs deflect when the insert presses against the board, providing contact with the signal trace pads.

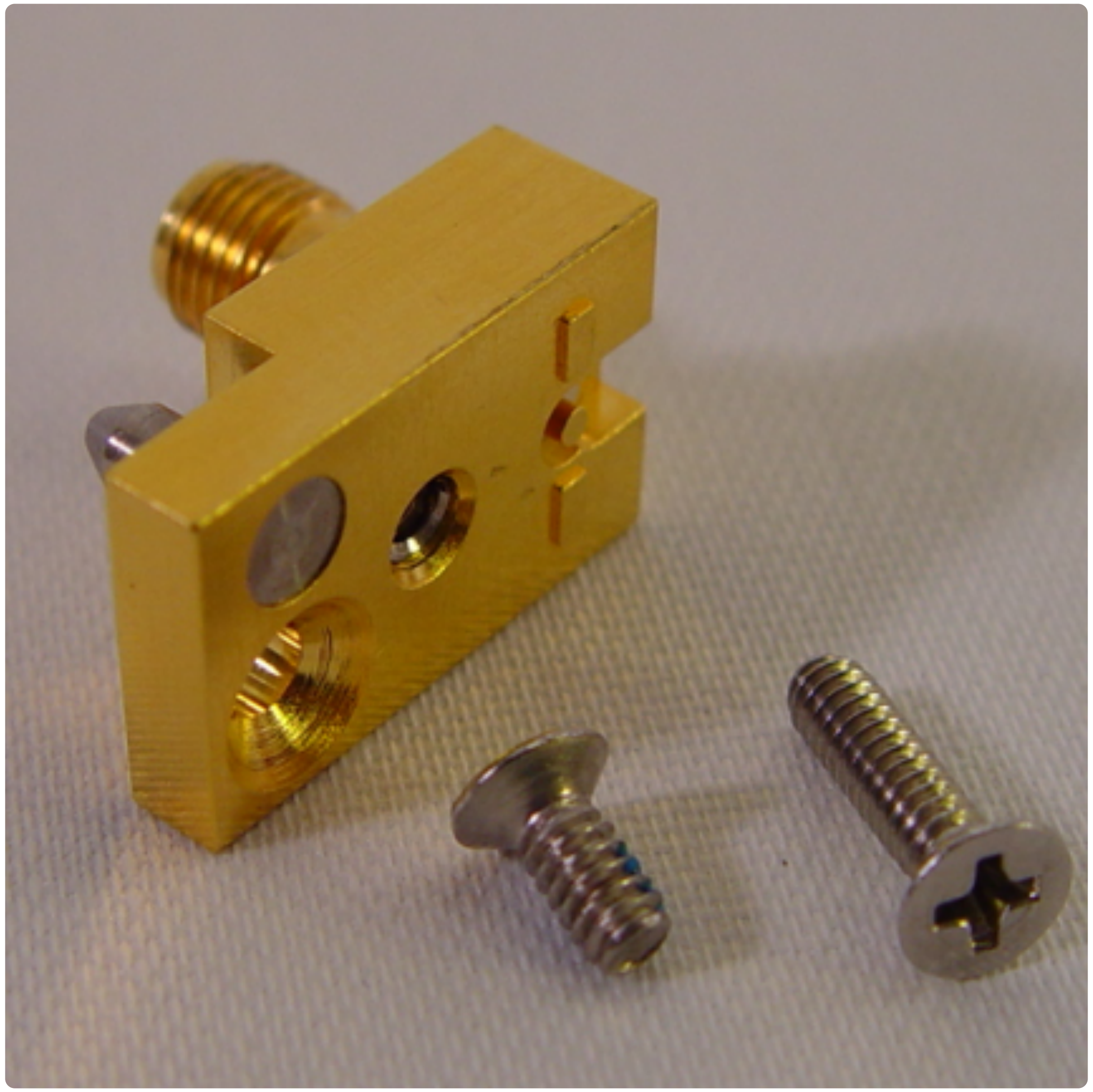


The graph above shows typical S11 performance of the Dual MCX launch.

RF (DC TO 15GHZ):

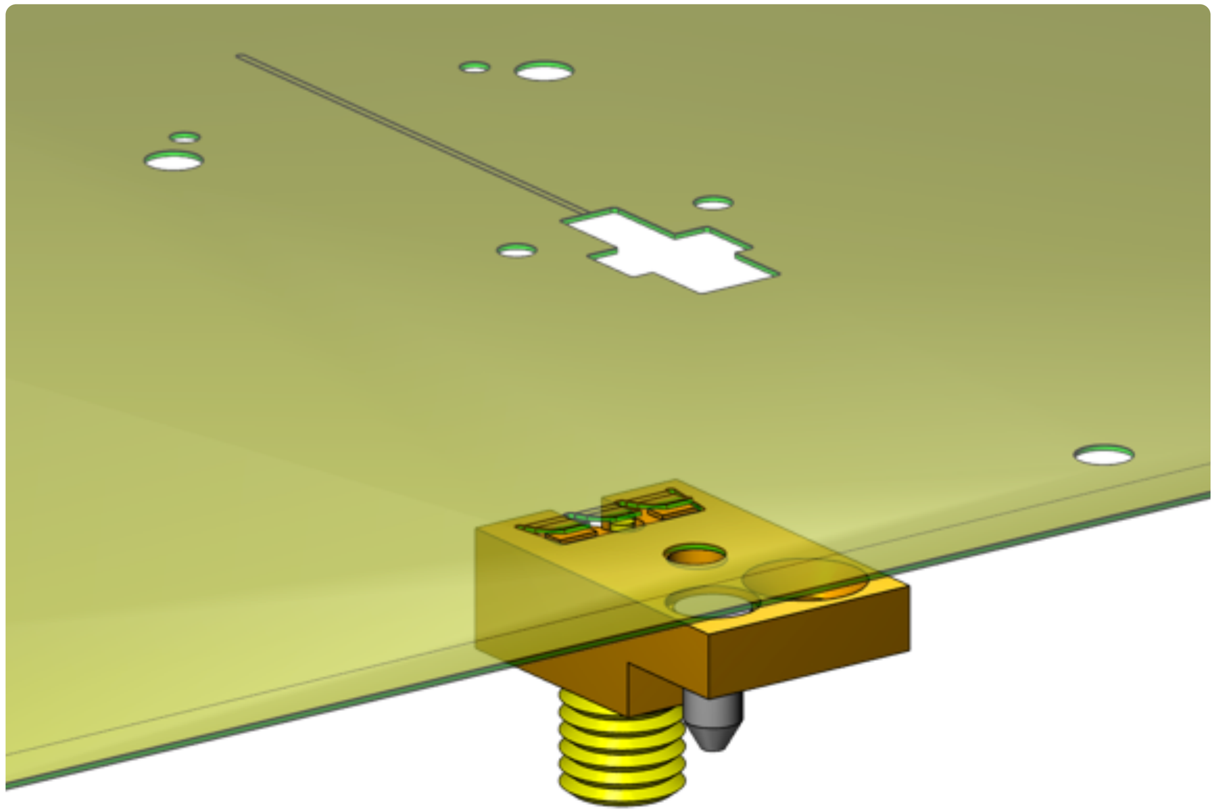
The RIK0212 SMA launch is used to route RF signals up 15GHz. The insert provides a single SMA connector for standard RF cable interfacing inside the fixture. The signal maps to a precision height launch pin that makes pressure contact with the PCB via a tab design. Ground pins etched onto the launch near the center conductor contact additional tabs that provide enhanced impedance matching. This launch does not require any snap-on or twist-type connection between the PCB and the launch, making it compatible with Quick-Lock DIB systems.

FIGURE 3.14 DUAL MCX RF LAUNCH INSERT

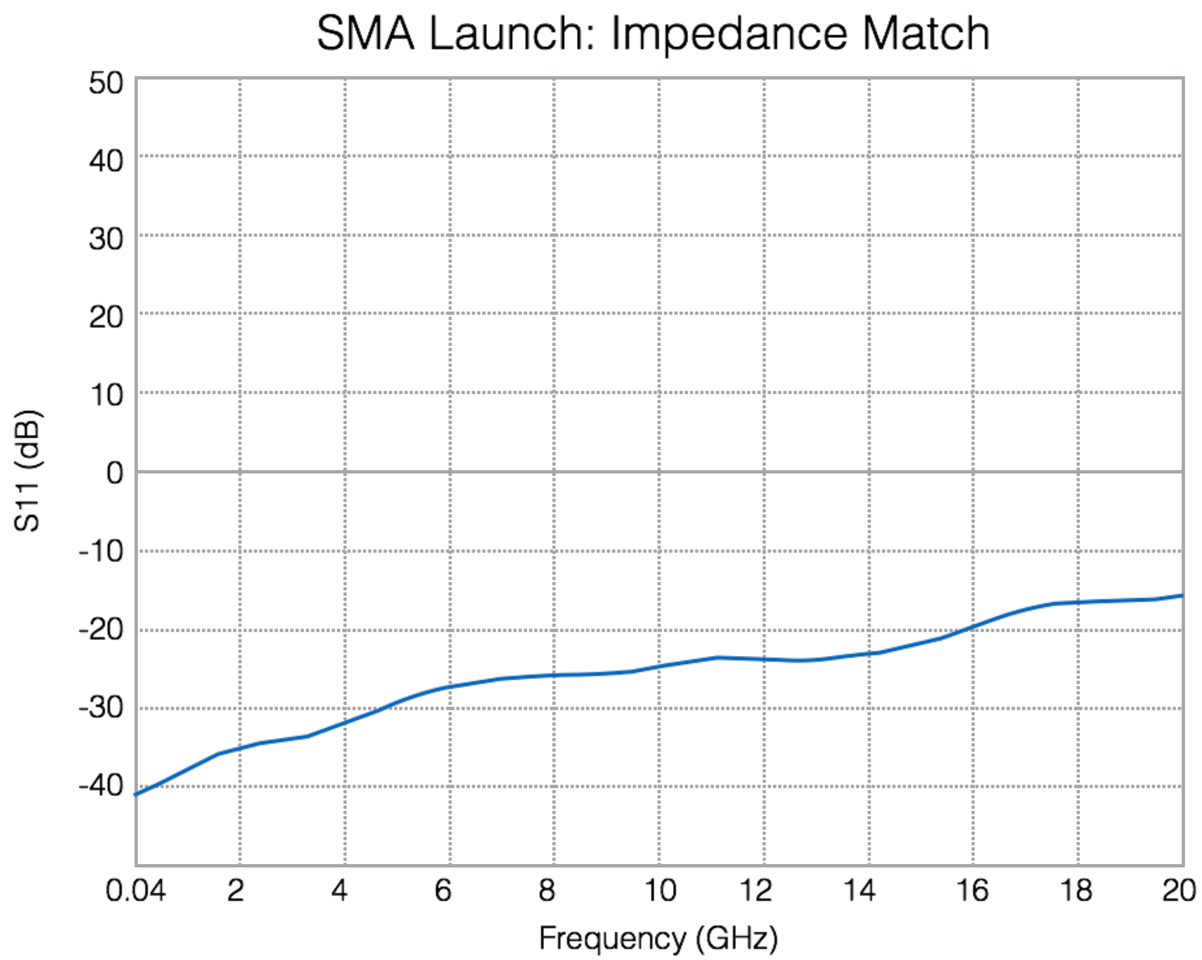


The image above shows the single SMA type RF launch insert. The launch connects to SMA-adapted RF cables within the fixture.

FIGURE 3.15 SMA RF LAUNCH CONTACTING PCB



The illustration above shows the SMA RF launch insert relative to the PCB. The signal tab(center) on the PCB deflects when the center conductor of the insert presses against the board. The ground tabs on the PCB deflect when the body contacts of the launch insert on either side of the center conductor contact with the ground trace pads.



The graph above shows typical S11 performance of the SMA launch.

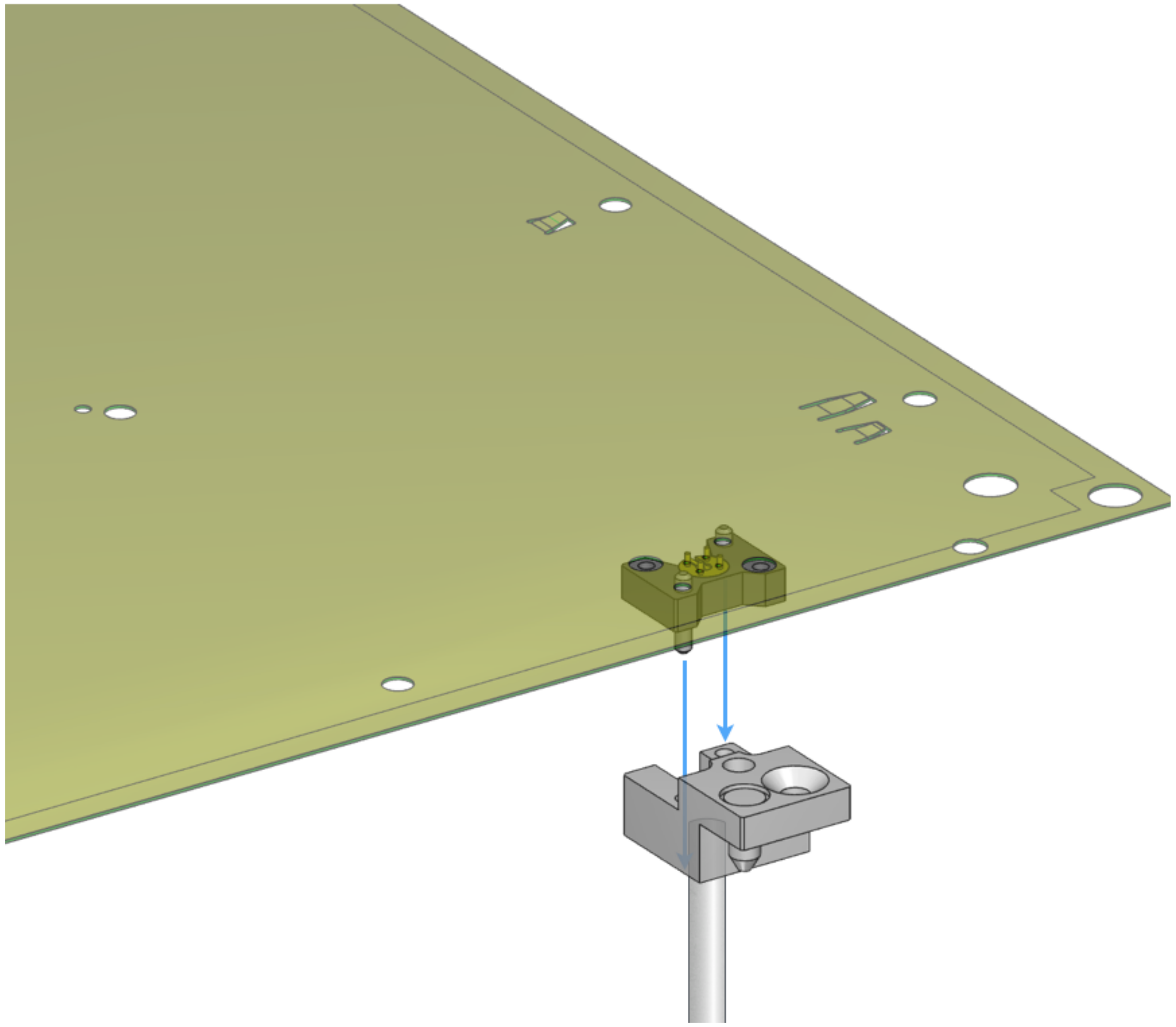
RF (DC TO 20GHZ):

The RIK0216 SSMP launch is used to route microwave signals up 20GHz onto a DIB. The insert encapsulates a four inch length of coaxial cable with a female SMA connector for standard RF cable interfacing inside the fixture and a female SSMP connector to contact with a mating pair on the DIB. This female SSMP connector mates to a male surface mount SSMP connector that is soldered to the PCB. The surface mount SSMP is encapsulated within a metal alignment bracket that provides added reinforcement during insertion and removal to alleviate the mechanical strain at the connector's solder joint(see RIK0217). This launch has built-in alignment tolerances and mechanical compliance for snap-on connection when the DIB is installed. It does not require any twist-type connection between the PCB and the launch, making it compatible with Quick-Lock DIB systems.

FIGURE 3.16 Dual MCX RF Launch Insert

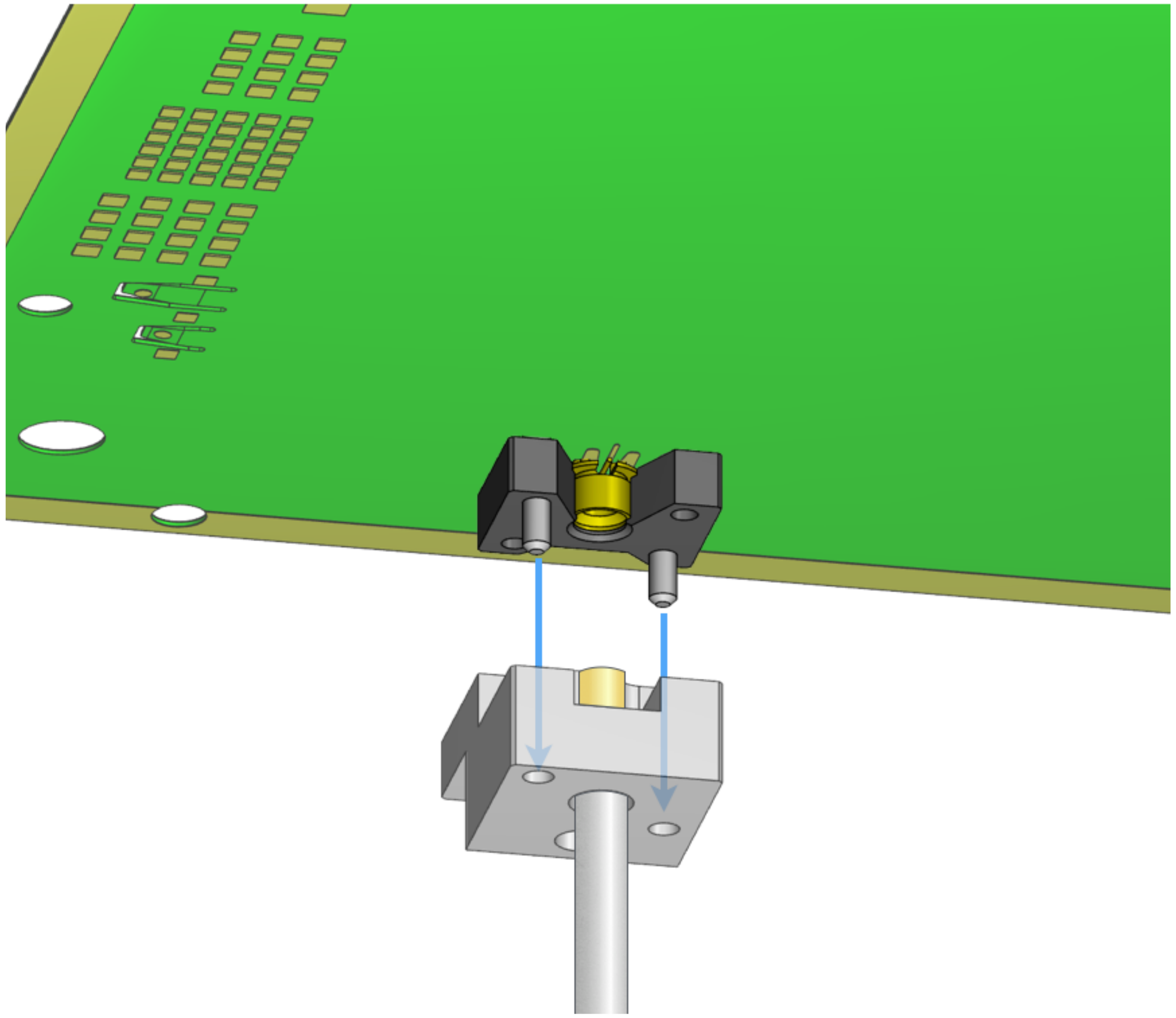
The image above shows the SSMP type microwave launch insert. The launch includes a pre-installed length of cable for SMA style connection with cables/connectors within the fixture.

FIGURE 3.17 SSMP Launch Contacting PCB (Top View)



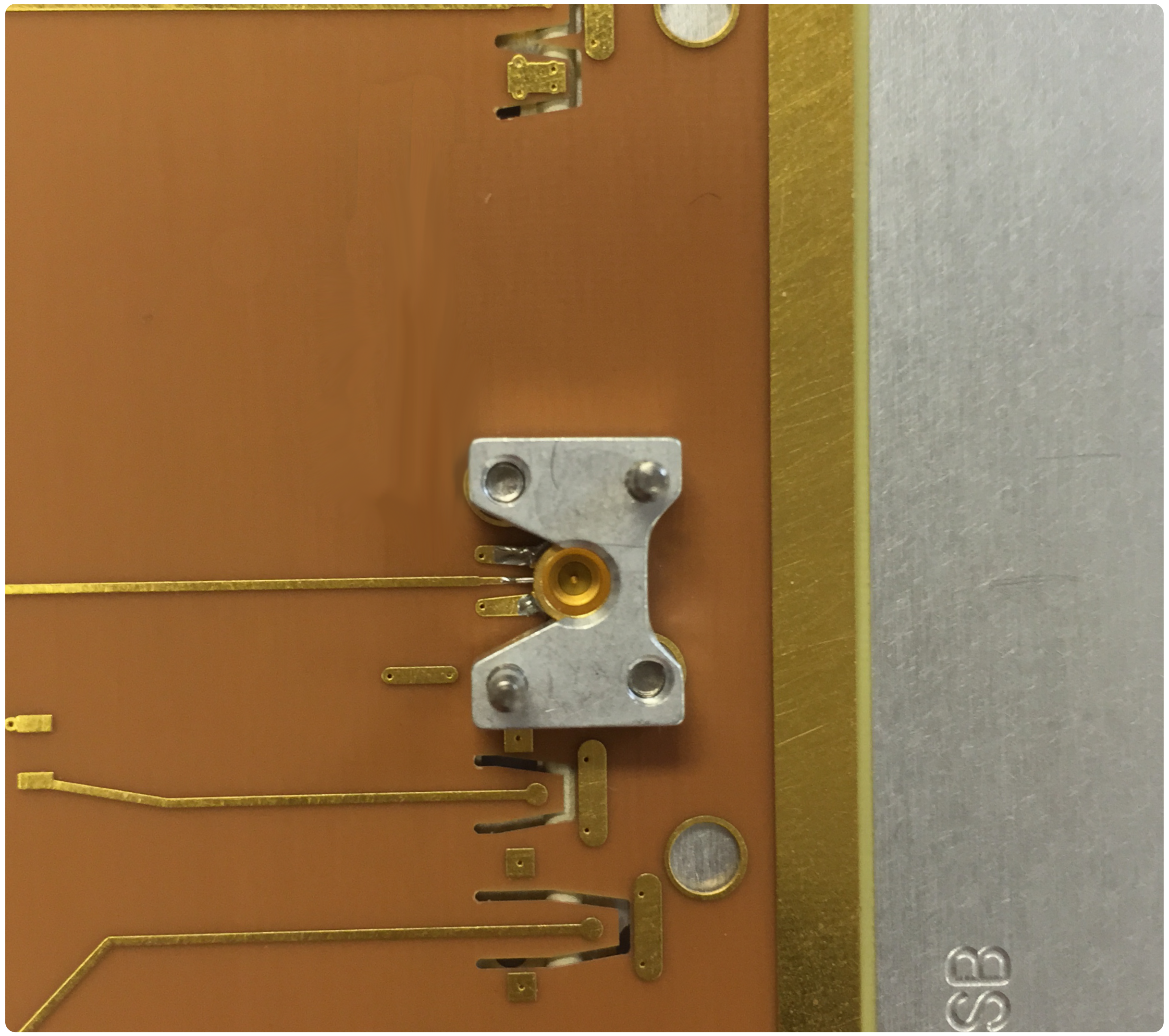
The illustration above shows the SSMP Microwave launch insert and connectorized launch on the the PCB from the top/handler view. The male SSMP connector is soldered to the underside of the PCB and encapsulated by the bracket that provides both alignment pins and reinforcement to the solder joint/PCB site when connecting and disconnecting the launch as part of the DIB sandwich. The bracket is secured to the PCB via two screws from the top of the board.

FIGURE 3.18 SSMP Launch Contacting PCB (Bottom View)

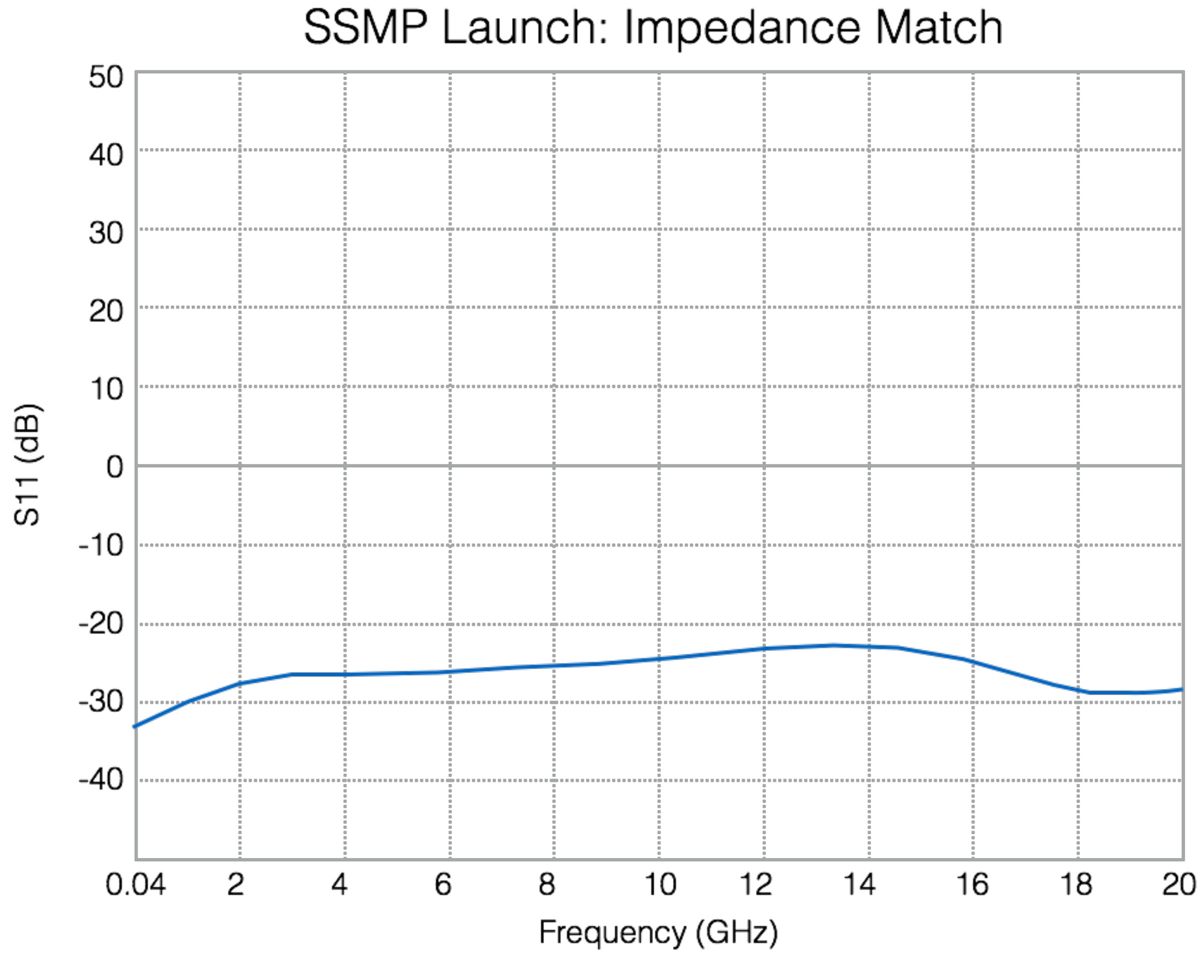


The illustration above shows the SSMP Microwave launch insert and connectorized launch on the the PCB from the bottom/fixture side. The male SSMP connector is soldered to the underside of the PCB and encapsulated by the bracket that provides both alignment pins and reinforcement to the solder joint/PCB site when connecting and disconnecting the launch as part of the DIB sandwich.

FIGURE 3.19 SSMP Launch Pad with Bracket



The picture above shows the SSMP Microwave launch on the underside or fixture side of the PCB. The surface mount male SSMP connector is soldered to the board, and the support/alignment bracket has been installed. The bracket is secured to the PCB via two screws from the top/handler side of the board.



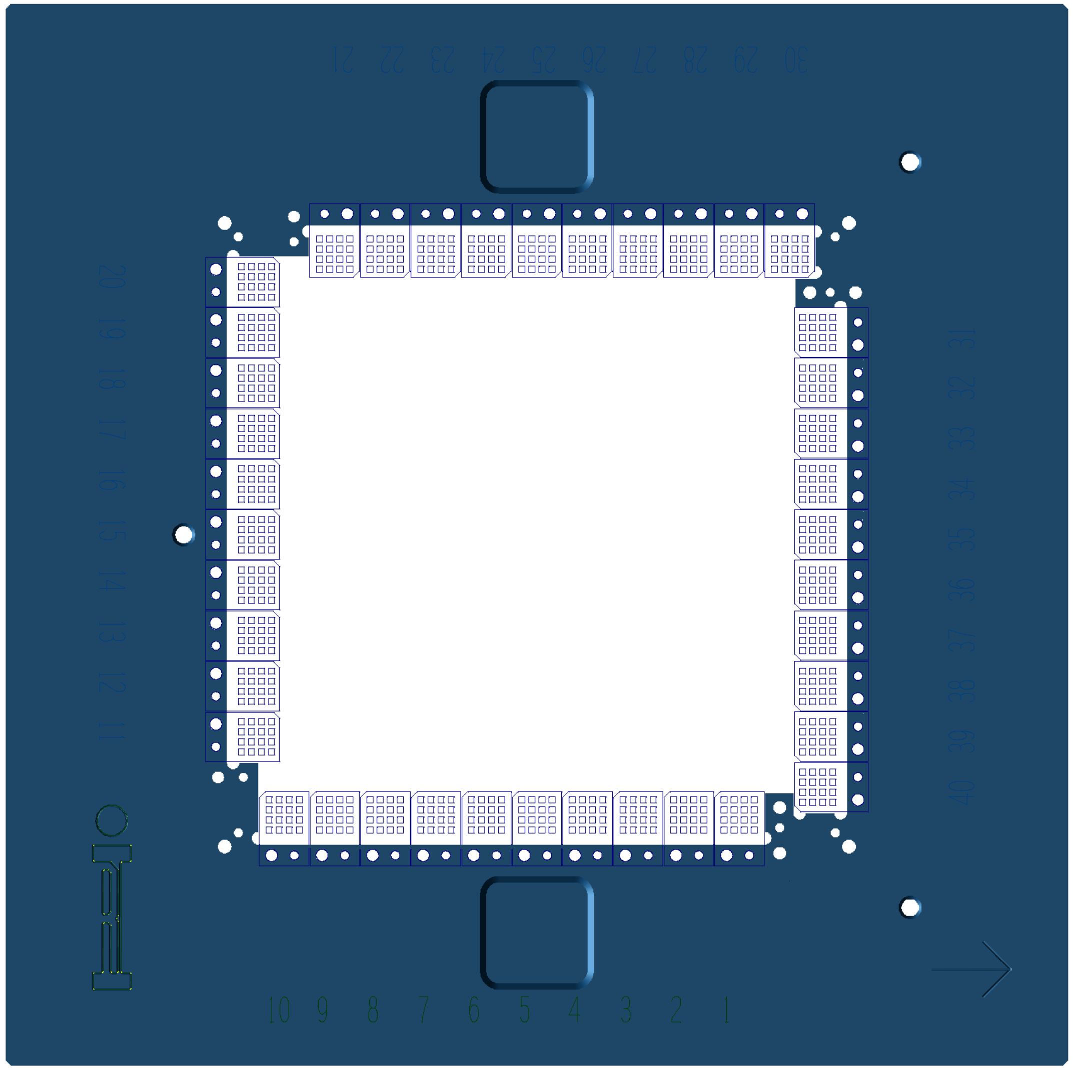
The graph above shows typical S11 performance of the SSMP launch.

Launch Placement

The signal launches are placed around the perimeter of the inner perimeter of the top plate in standard insert locations. The top plate insert attachment points and launches use a universal design allowing virtually any signal launch in any of the positions, with exceptions provided herein. The following figures provide the available launch positions based on the launch type.

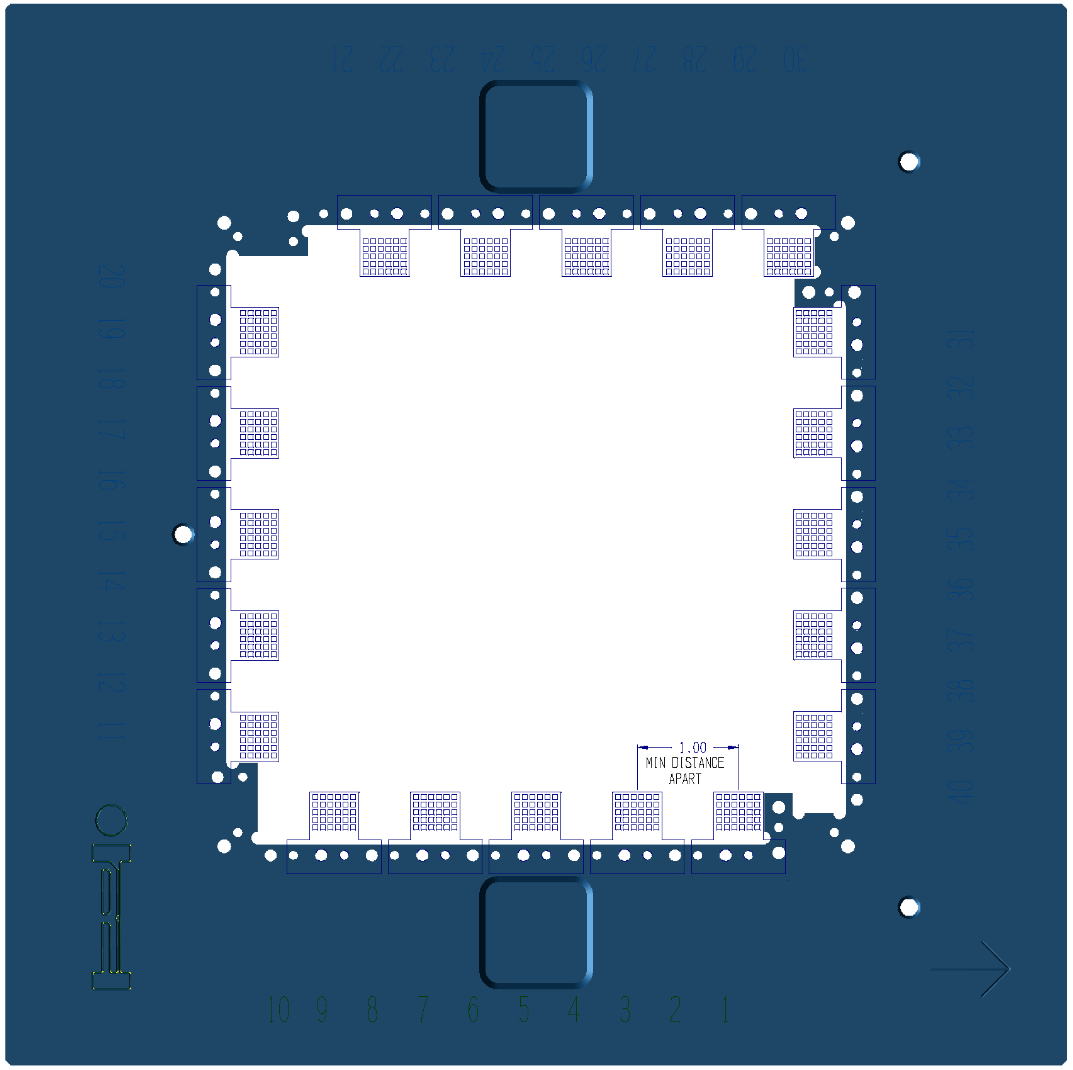
NOTE: If a center bar insert is used in the top plate, note that positions 4-6, 14-16, 24-26, and/or 34-36 on the top plate may be occupied by the cross beam attachment points.

Figure 3.20 DC Launch Top Plate Positions



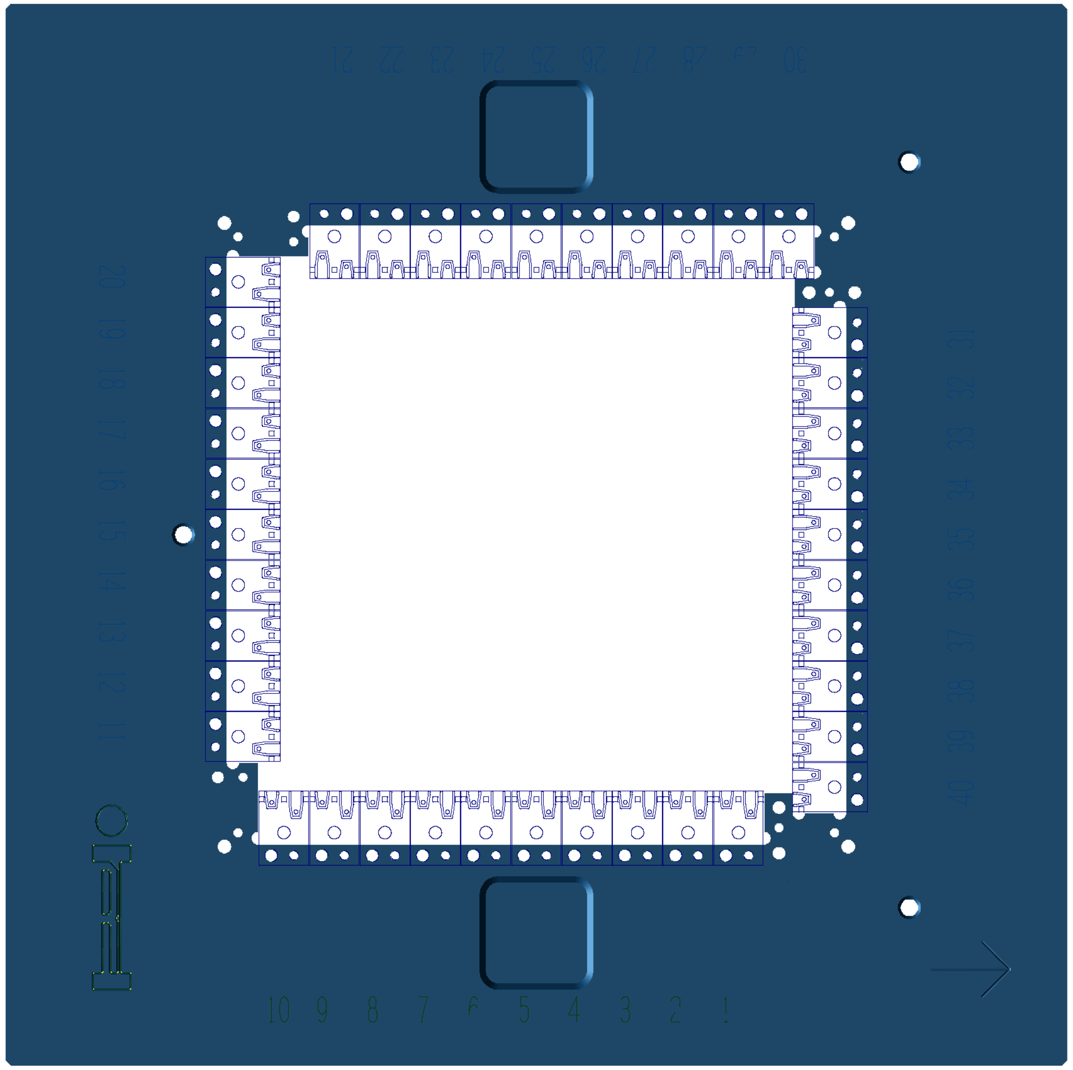
The above shows the available positions in the top plate for the 16-pin DC launch insert

FIGURE 3.21 Digital Launch Top Plate Positions



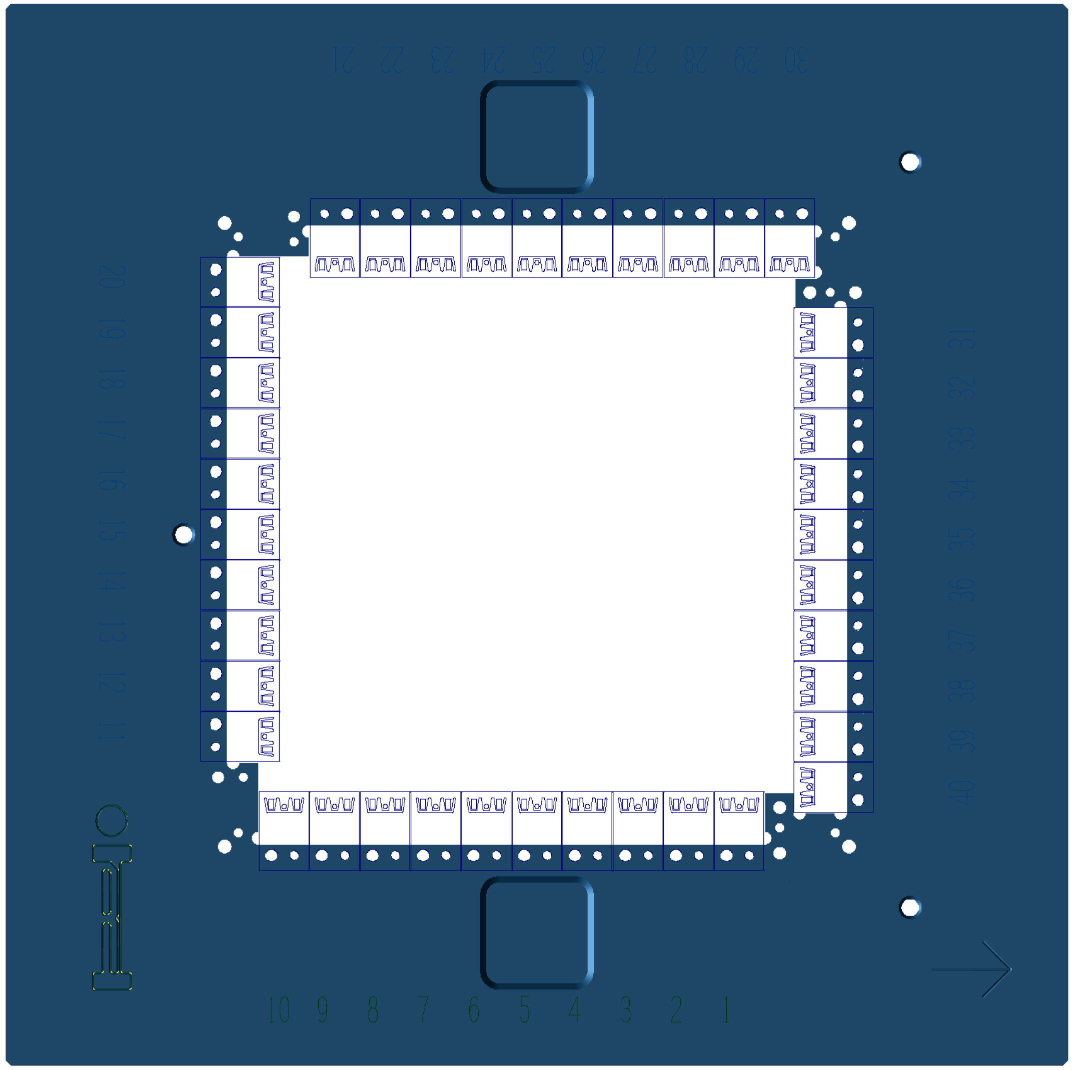
The above shows the available positions in the top plate for the digital launch insert. Note that digital inserts cannot be placed adjacent to one another.

FIGURE 3.22 Dual MCX RF Launch Top Plate Positions



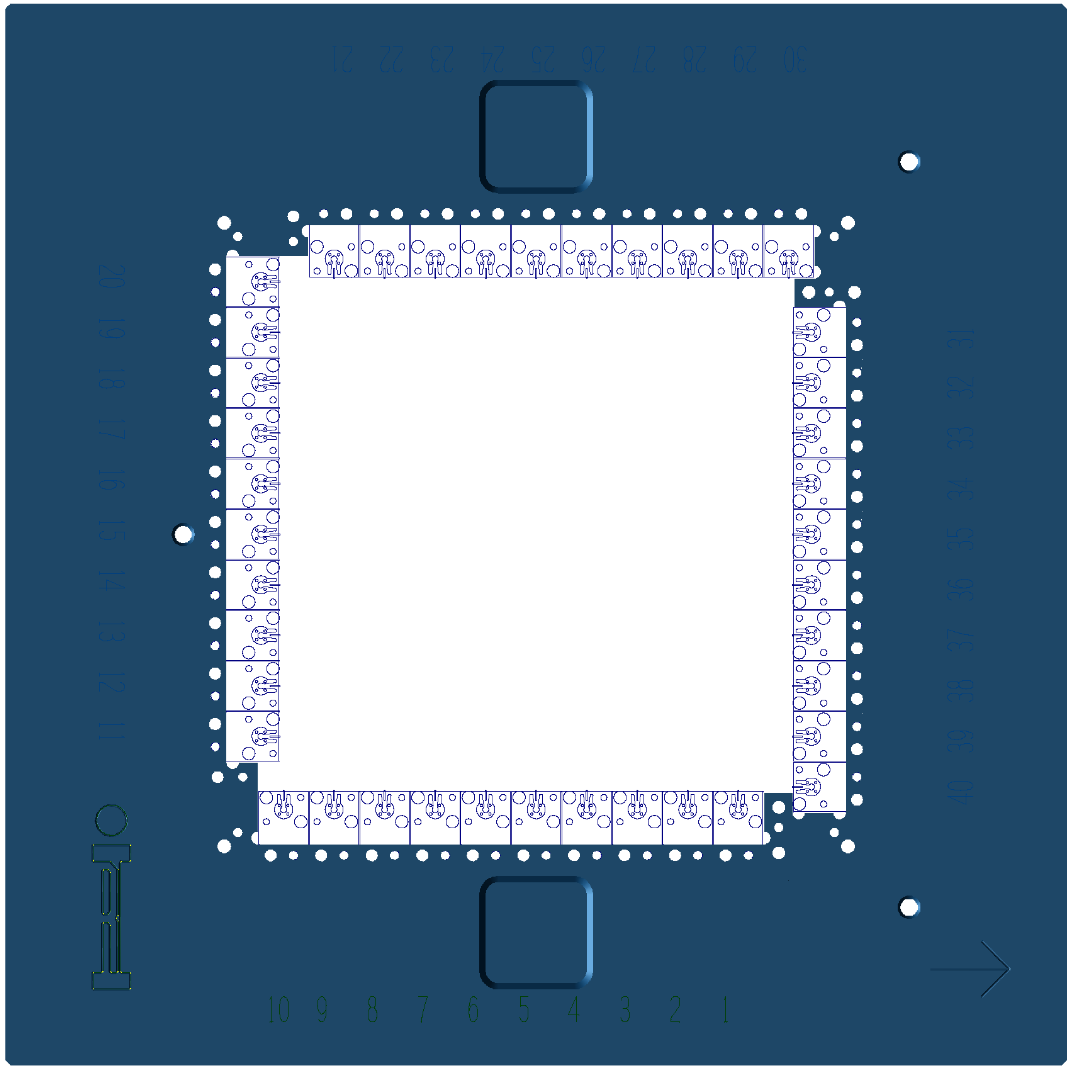
The above shows the available positions in the top plate for the dual MCX RF launch insert

FIGURE 3.23 SMA RF Launch Top Plate Positions



The above shows the available positions in the top plate for the SMA RF launch insert

FIGURE 3.24 SSMP Microwave Launch Top Plate Positions



The above shows the available positions in the top plate for the SSMP microwave launch insert

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