Norsat International Inc.

MAINTENANCE MANUAL

GLOBETrekker™

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Purpose and Scope of the User Guide

This maintenance manual explains procedures to:

- Perform basic field maintenance during deployment
- System repair to the level of module replacement

Audience

The guide will be of interest to the following personnel:

- Skilled Maintenance Technicians
- Systems administrators (or IT; Lifecycle/Sustainment Managers)

READ THE MANUAL BEFORE YOU ATTEMPT REPAIRS OR MAINTENANCE ON THE GLOBETrekker™

1. Basic Maintenance

1.1 Basic Maintenance Intervals

Procedure	Frequency
Clean baseband unit dust filters	Monthly Weekly in a dusty environment or after a sandstorm
Grease elevation screw jack	Monthly
Visual inspection	After field assembly, then: Monthly Weekly in a dusty environment or after a sandstorm
Store USB image	As required Image can be used for emergency recovery
Cleaning the Elevation Rod and Nut	As required
Elevation Nut Replacement	As required

1.2 Cleaning the Filters

The dust filters are located at each end of the baseband unit under covers.

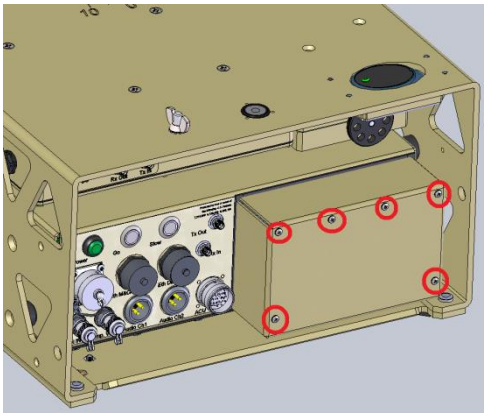
The inlet filter element is a fine-mesh material (located on the front of the Baseband) and the exhaust filter is coarse (located on the rear of the unit).

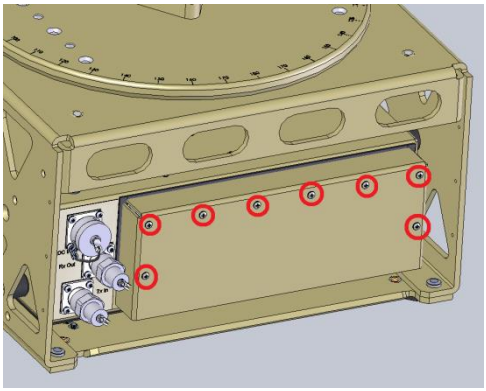
Tools Required

- Source of dry compressed air, or soap and clean water
- #2 Phillips screwdriver

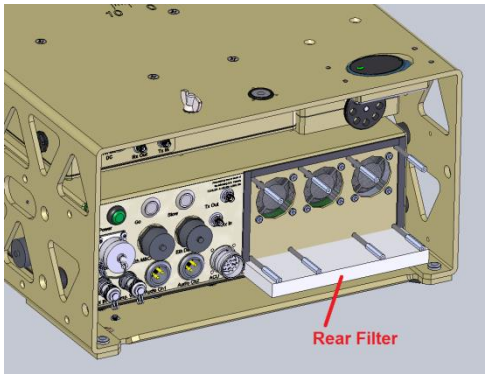
Procedure

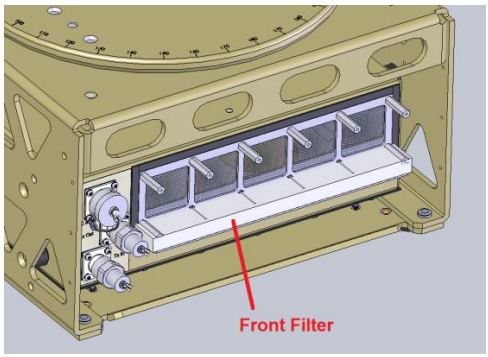
1. Remove the screws from the front and rear covers.





2. Remove the filter elements.





3. Clean the filter element by blowing out with clean, dry compressed air, or wash with soap and water. Rinse and dry thoroughly.

4. Replace the filter elements.

5. Replace the filter covers and secure the fasteners.

1.3 Greasing Elevation Screw Jack (applies to 1.2m GT only)

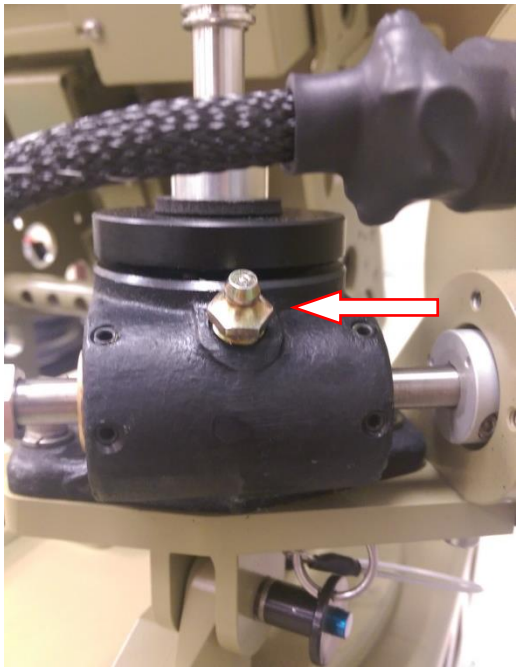
Due to normal use, small amounts of grease will escape through the bearings in the screw jack. Monthly replenishment is recommended to maintain smooth actuation and maximize wear life.

Tools Required

- Grease Gun
- Shell Albida® LC EP2 grease, (Shell Product Code 70311)
    - If this grease is not available in your area please contact your local supplier for their recommendations.
    - Warning: Greases containing molybdenum disulfide should never be used.

Procedure

1. Clean away any dirt from grease nipple
2. Connect grease gun and fill as necessary



1.4 Visual Inspections

Visual inspection is an examination of the external condition of the system hardware including housings, fasteners, and cables.

Perform a visual inspection during and after system assembly, as well as at the recommended intervals while in service.

Tools Required

- Not applicable

Procedure

Inspect the general integrity of the overall system with special attention to the following components:

1. All cables.

   Check for any indication of damage including fraying, pinching, cuts.

   Ensure ACU cables are clear of pinch points but free to move with antenna azimuth and elevation changes.

2. All cable connectors.

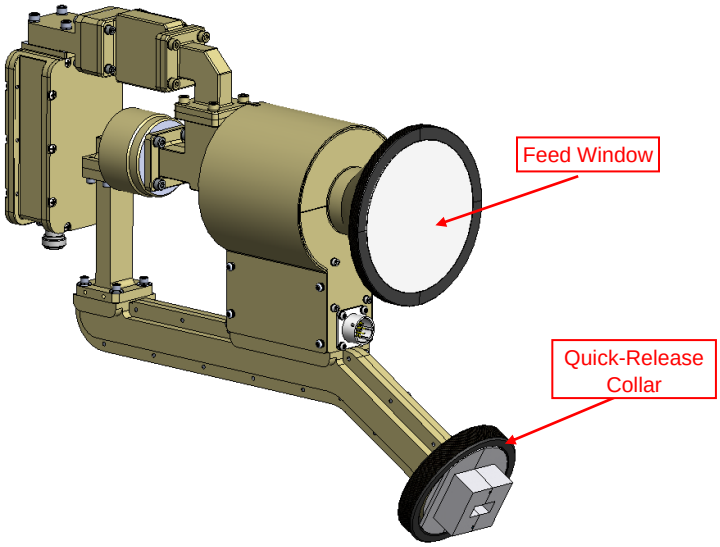
   Ensure all connectors are secure.

3. Ku-band upper boom feed.

   Ensure Feed Window is intact.

   Ensure quick-release collar threads are clean; lubricate if required with Teflon or other non-oil base lubricant (oil based lubricants may become sticky and attract contaminants).

   Note; illustrations shown are not applicable to all GlobeTrekker Systems.

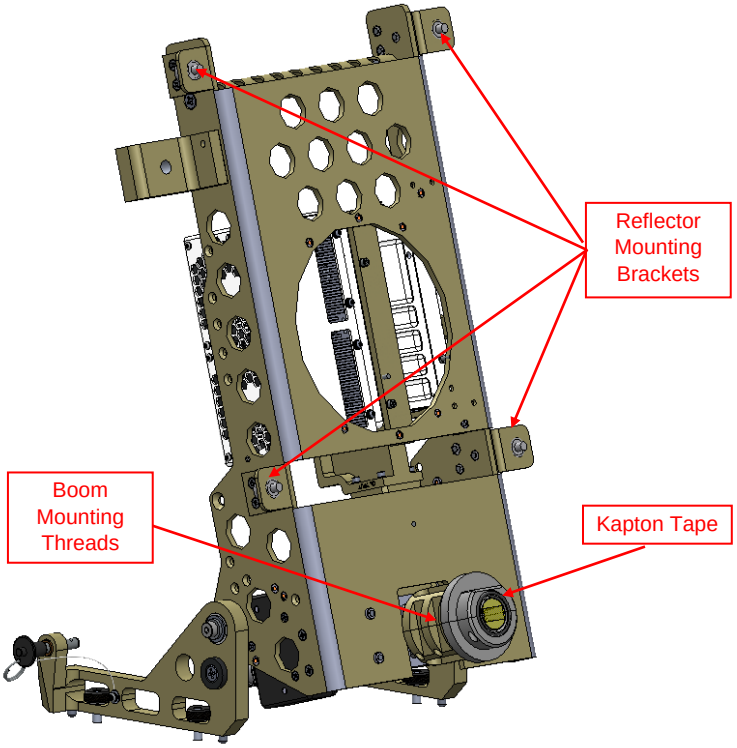


4. Ku-band lower boom.

   Clean and lubricate threads with non-oil base lubricant.

5. Ku-band back plate lower boom attachment point.

   Check Kapton tape integrity, ensure boom mounting threads are clean, and ensure reflector mounting brackets are not damaged or bent.



6. Check that all external fasteners are secure.

1.5 Store USB Image

In the event of a drastic field failure it is prudent to take regular snapshots of the system image. This can be saved on a network or remote drive.

Tools Required

- USB key of 8GB or larger (preferably the one provided by Norsat)
- Computer with the capability to edit text files on the USB key
- USB hub with at least 2 free ports
- USB keyboard

Procedures

To create your own USB key:

1. Ensure that the USB key has been formatted for FAT32.
2. Copy the entire contents of the Norsat-supplied Recovery USB key to your USB key. You should see the following files on your USB key after the copy has finished:
    - `\chain.c32`
    - `\initrd.gz`
    - `\kernel`
    - `\menu.c32`
    - `\reboot.c32`
    - `\syslinux.cfg`
    - `\syslinux.cmd`
    - `\syslinux.exe`
    - `\backup\bios`
    - `\backup\HDD_Look.txt`
    - `\backup\sda`
    - `\backup\sda1.000`
    - `\backup\sda1.first_sectors`
3. Launch a Command Prompt window with Administrator privileges.

    If you are running under Windows XP or earlier, then the default Command Prompt window already has Administrator privileges.

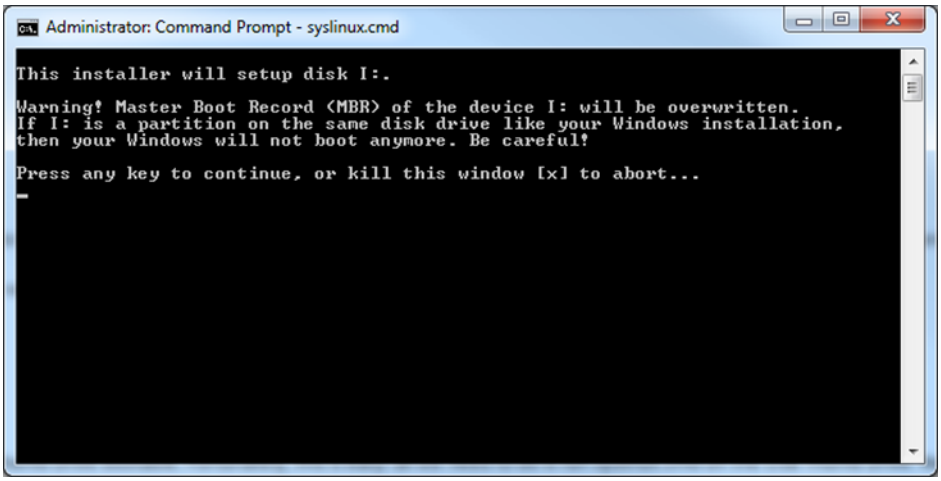
    If you are running under Windows Vista or later, find the Command Prompt entry in the Start Menu (usually **Start > Accessories > Command Prompt**), right-click on the Command Prompt entry, and select **Run as administrator** from the resulting pop-up menu.

4. In the Command Prompt window, navigate to the root folder of the USB key.

5. Enter the following command in the Command Prompt window:

   ```
   syslinux.cmd
   ```

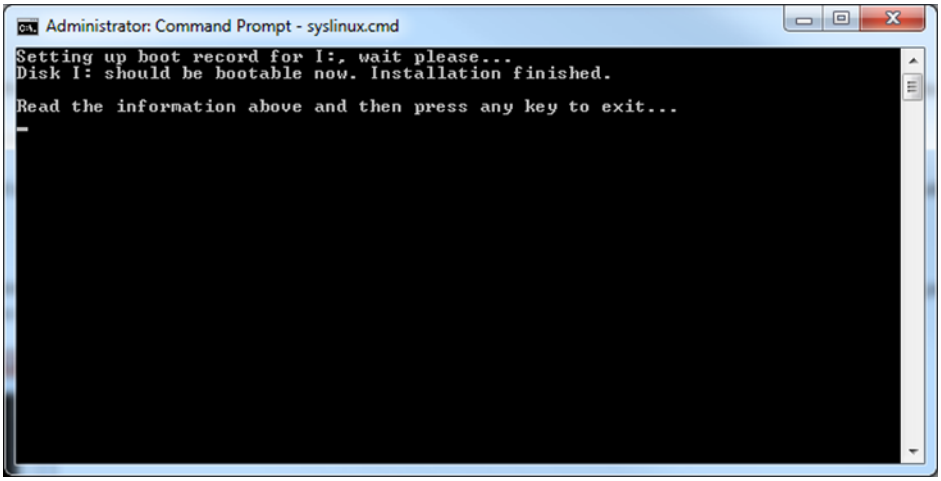
6. You should see a screen similar to the following:



   Verify that the disk letter shown on the first line matches the drive letter that was mapped to your USB key. If it does not, then **close the Command Prompt window immediately** and go back to Step 3.

7. Press the Enter key to continue.

8. After a few seconds, you should see a screen similar to the following:



9. Press the Enter key to complete the command, and then close the Command Prompt window. The USB key should now be ready for use.

To perform a backup:

1. Insert the USB key in your computer and wait for the key to authenticate.
2. Using a text editor open the file “syslinux.cfg” found in the root of the USB key
3. Change the text at the lead of the file from

   DEFAULT RECOVERY

   to

   DEFAULT BACKUP
4. Save the file and exit your editor.
5. Connect the USB hub to the USB slot of the GLOBETrekker™.
6. Insert the USB key and the USB keyboard into free ports on the USB Hub.
7. Power on the GLOBETrekker™.
8. Press the Delete key on the USB keyboard to interrupt the boot process and bring up the BIOS.
9. Use the arrow keys to navigate to the **Boot** tab.
10. Set **Boot Option #1** to the entry corresponding to the USB key.
11. Use the arrow keys to navigate to the **Save & Exit** tab.
12. Select **Save Changes and Exit**. The BIOS will exit and the GLOBETrekker™ will reboot.
13. The Backup process will begin automatically and will save the image on the USB stick. Wait for the system to halt.
14. Remove the USB hub from the GLOBETrekker™.
15. Remove the USB key from the USB hub and then insert the USB key in your computer and wait for the key to authenticate.
16. Using a text editor open the file “syslinux.cfg” found in the root of the USB key
17. Change the text at the lead of the file from

    DEFAULT BACKUP

    to

    DEFAULT RECOVERY
18. Save the file and exit your editor.

1.6 Cleaning the Elevation Rod and Nut

The elevation rod and nut are designed and manufactured with tight tolerances to minimize backlash and play during operation. This may cause undesirable noise during operation.

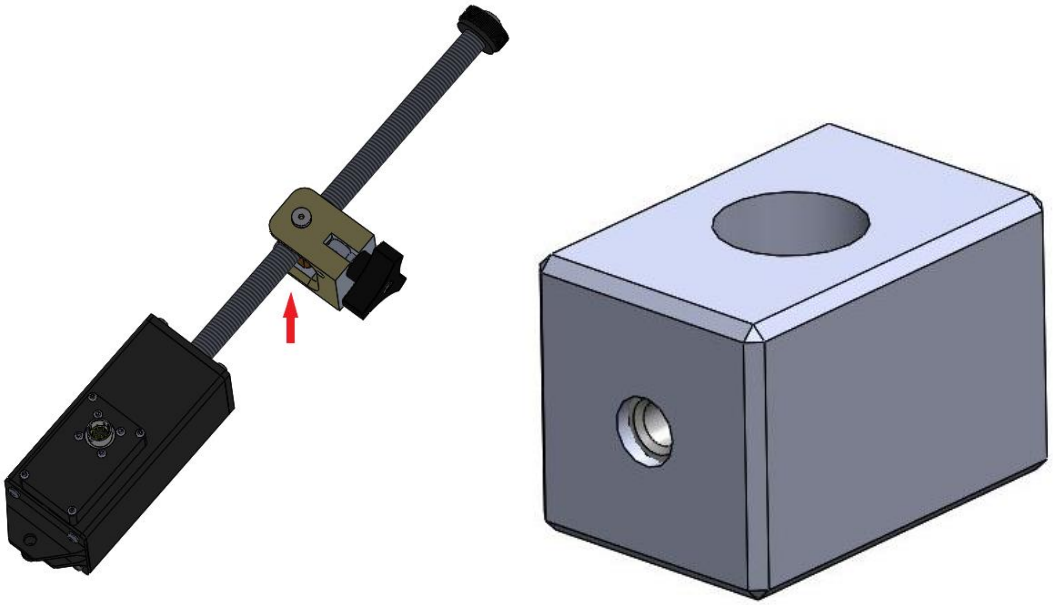
Tools Required

- Brush

Procedure

1. Brush off any dirt or contaminant on the elevation rod using a provided brush.

1.7 The Elevation Nut Replacement

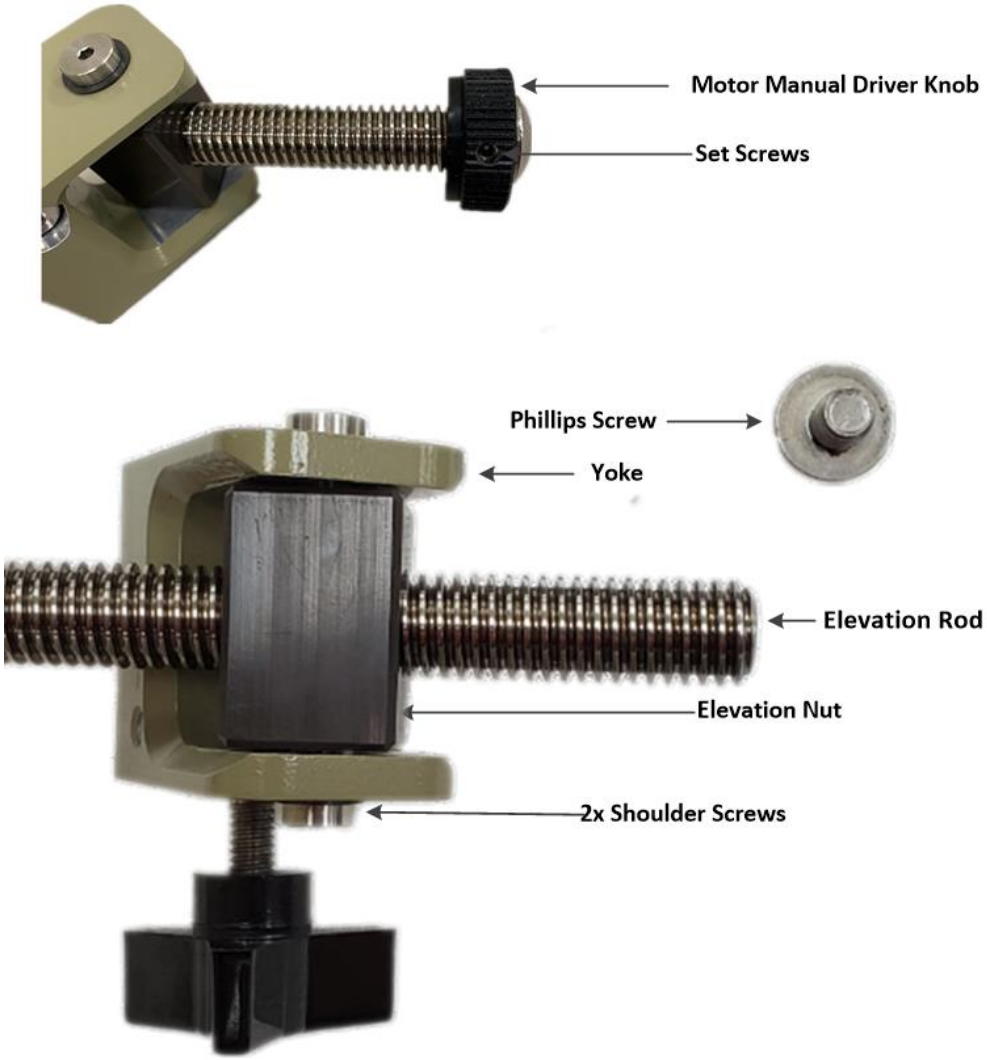


Tool Required:

- No. 3 Phillips Screwdriver;
- 3/32” Hex Driver;
- 3mm Hex Driver.

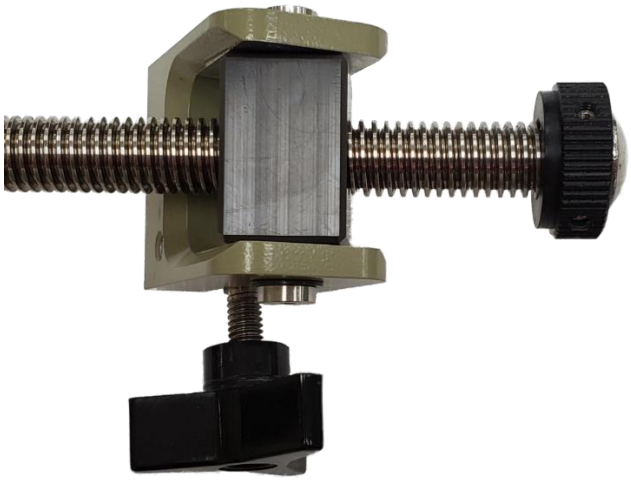
Procedure:

1. Unscrew the Phillips screw on the end of the elevation rod using No.3 Phillips screwdriver.
2. Remove the Motor Manual Drive Knob on the end of the elevation rod using 3/32” hex driver to open its set screws.



3. Rotate and slide the whole quick release assembly out from the rod.
4. Unscrew two shoulder screws on the quick release assembly using 3mm hex driver.

5. Replace the elevation nut with the new one in the yoke, ensure the tapped holes on the nut are aligned with the bushing holes on the yoke.
6. Tighten two shoulder screws on the yoke using 3mm hex driver.
7. Rotate and slide the quick release assembly back onto the elevation rod.
8. Slide the knob onto the elevation rod. Do not tighten set screws before step 10.
9. Tighten the top Phillips screws back to the end of elevation rod using No.3 Phillips screwdriver.
10. Move Motor Manual Drive knob against the Phillips screw and tighten its set screws.

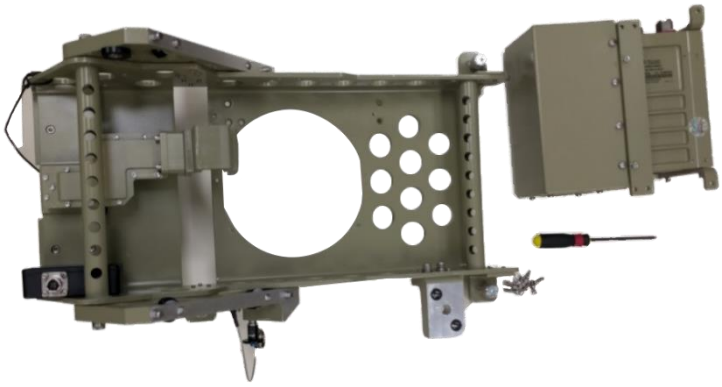


2. Advanced Maintenance

2.1 Ku-Band ATOM BUC Replacement, Low Power

Replace the Ku-band ATOM BUC in a clean environment.

Gray and blue seals are electrically conductive.
Black and red seals are non-conductive.
Using incorrect replacement seals could degrade system operation.

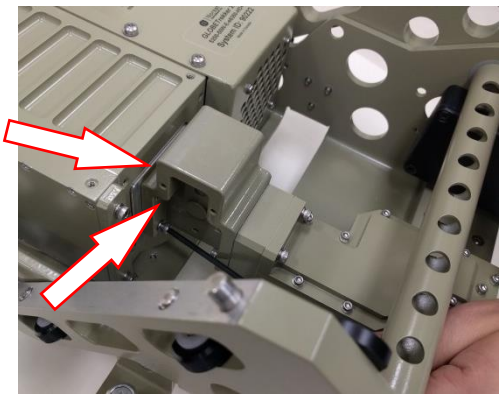


Tools Required

- 7/64-inch Hex Driver (Allen Key) with Spherical Tip

Ku-Band ATOM BUC Removal, Low Power

1. Remove (4) 6-32 x 1/2” screws (with washers) from the waveguide connection.

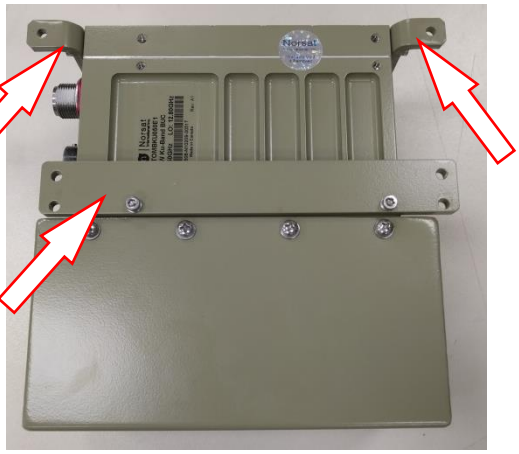


2. Remove (4) 6-32 x 3/8” screws (with washers) that are fastening the ATOM BUC brackets to the RF Backplate.

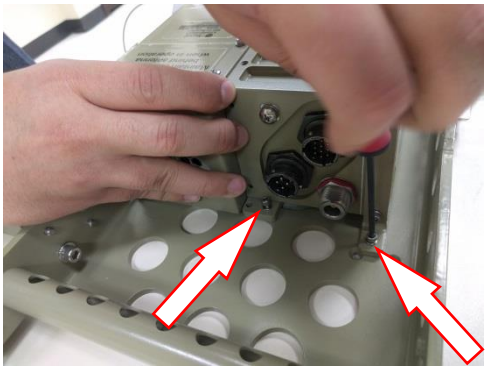
3. Lift the BUC off the RF Backplate and unfasten the (6) 6-32 x 3/8” screws (with washers) to remove the 3 ATOM BUC brackets.

Ku-Band ATOM BUC Installation, Low Power

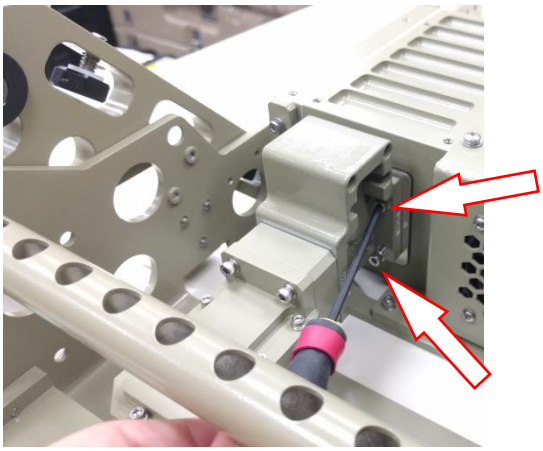
1. Loosely fasten 3 mounting brackets onto BUC: Using (6) 6-32x3/8” screws (with washers)



2. Align the waveguide connections and fasten the BUC brackets onto the RF Backplate using (4) 6-32x3/8” screws (with washers).



3. Lightly fasten waveguide connection using (4) 6-32 x 1/2” screws (with washers).



4. Tighten all fasteners once waveguide alignment is complete.

Caution: Align the holes, brackets, and screws carefully to avoid damaging the threads in the BUC housing.

2.2 Ku-Band ATOM BUC Replacement, High Power

Replace the Ku-band ATOM BUC in a clean environment.

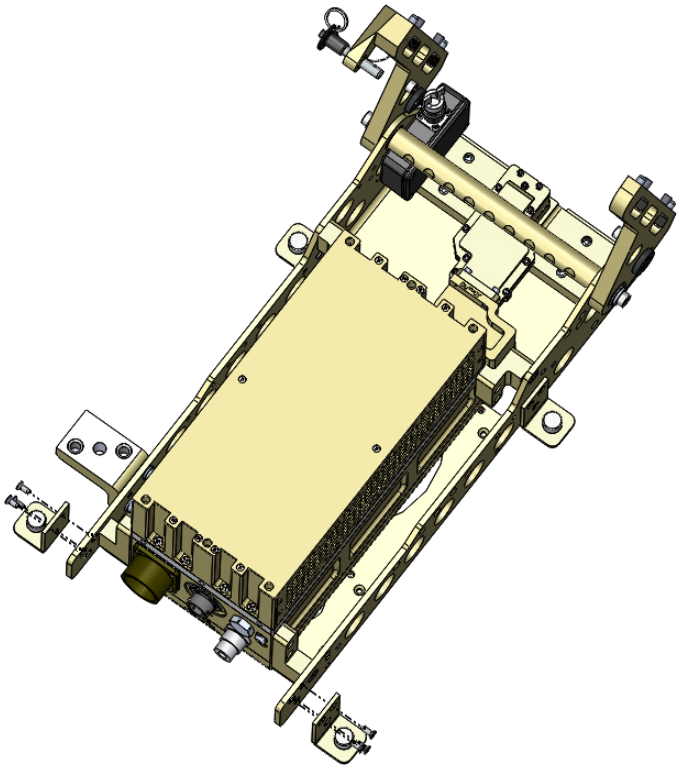
Gray and blue seals are electrically conductive.
Black and red seals are non-conductive.
Using incorrect replacement seals could degrade system operation.

Tools Required

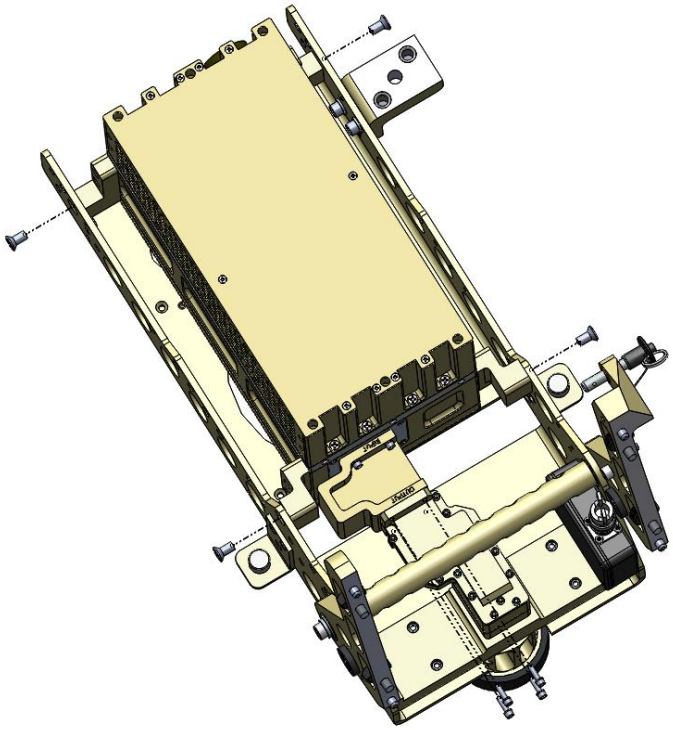
- 7/64-inch Hex Driver (Allen Key) with Spherical Tip
- 9/64-inch Hex Driver (Allen Key) with Spherical Tip
- #2 Phillips screwdriver
- #3 Phillips screwdriver

Ku-Band ATOM BUC Removal, High Power

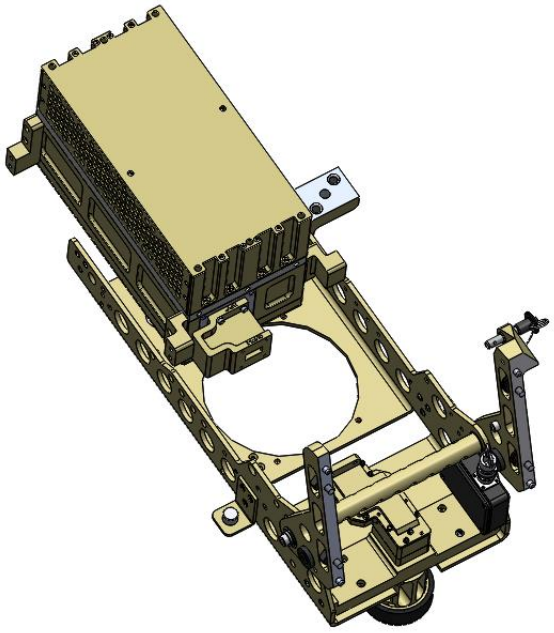
1. Unfasten six (6) #8-32 Phillips flat head screws using a #2 Phillips screwdriver to remove the antenna bracket.



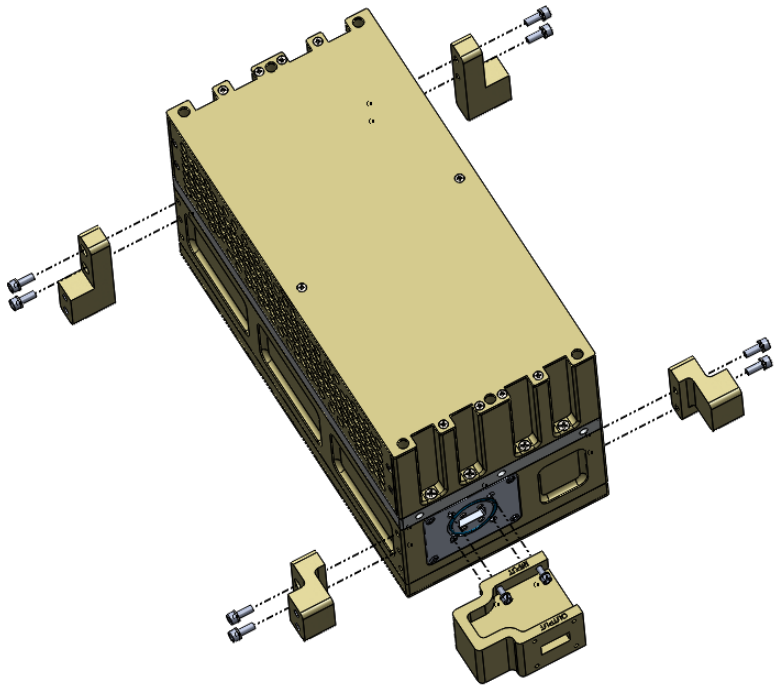
2. Unfasten four (4) 1/4-20 Phillips flathead screws on the BUC bracket using a #3 Phillips screwdriver and four (4) #6-32 socket head screws on the waveguide isolator using a 7/64” hex driver.



3. Carefully remove the BUC from the RF backplate.



4. Remove the brackets and isolator from the BUC by unfastening eight (8) #8-32 socket head screws using a 9/64” hex driver and two (2) #6-32 socket head screws using a 7/64” hex driver.



Ku-Band ATOM BUC Installation, High Power

1. Replace the BUC and fasten the BUC back to the backplate using the tools and fasteners described above. Ensure the waveguides are aligned and fastened before fastening the brackets. Ensure the fasteners are fastened with Loctite. Use Loctite 222 for fasteners under ¼” (6mm) and Loctite 242 for fasteners over ¼” (6mm).

Caution: Align the holes, brackets, and screws carefully to avoid damaging the threads in the BUC housing.

2.3 Ku-Band 4W BUC Replacement

Replace the Ku-band 4W BUC in a clean environment.

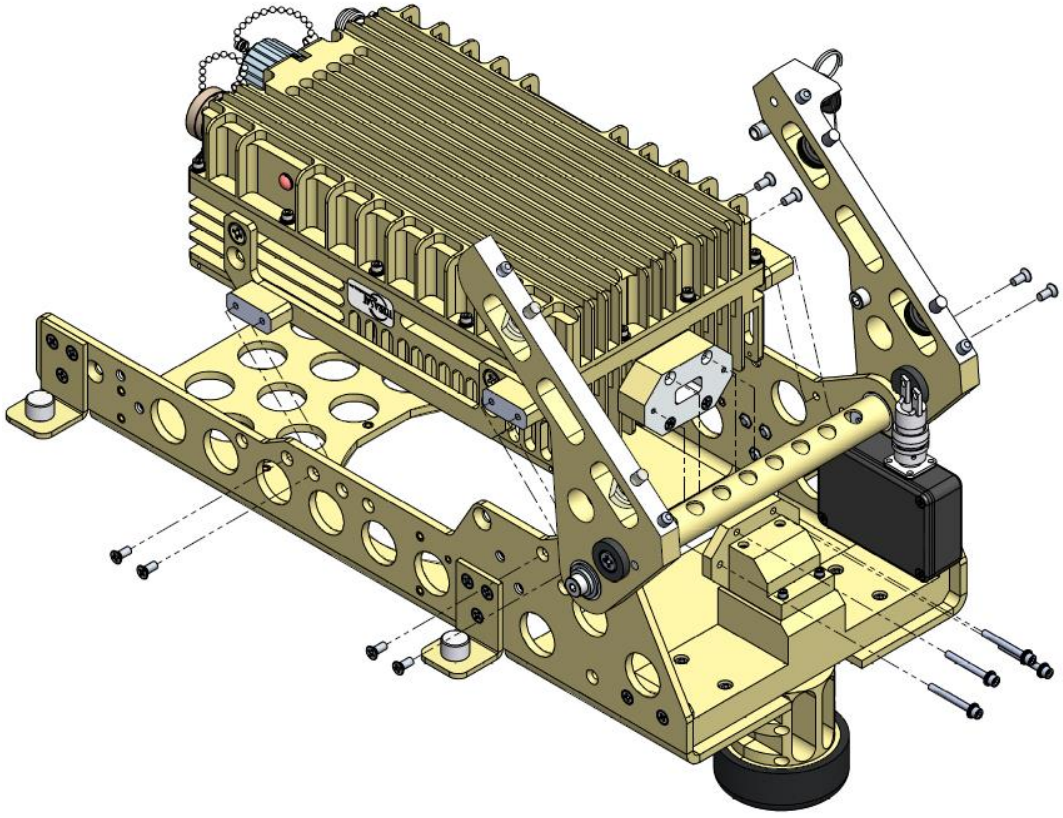
Gray and blue seals are electrically conductive.
Black and red seals are non-conductive.
Using incorrect replacement seals could degrade system operation.

Tools Required

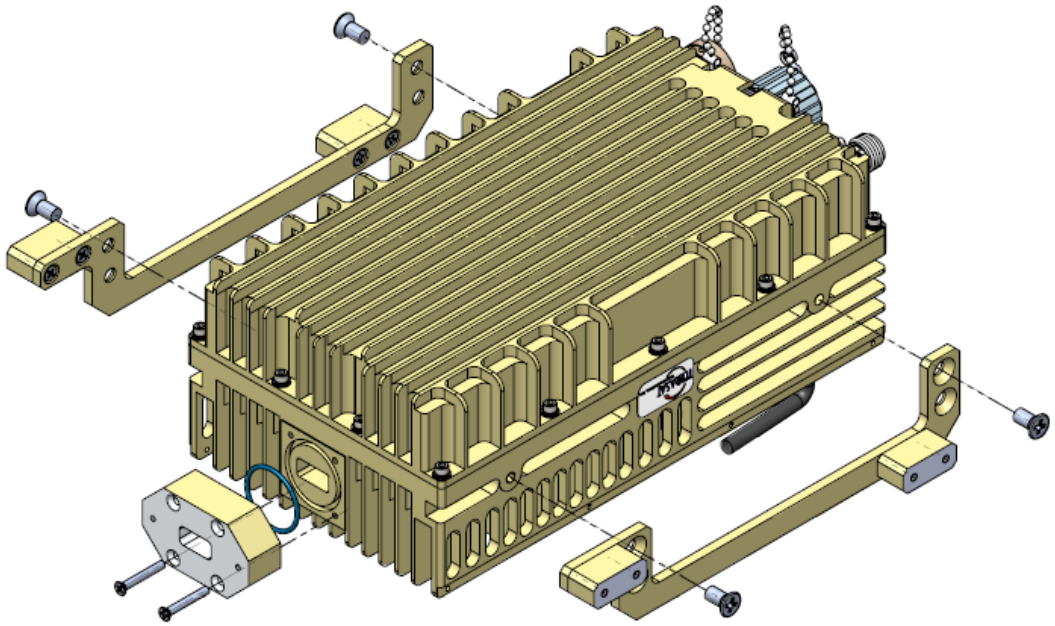
- 7/64-inch Hex Driver (Allen Key) with Spherical Tip
- #2 Phillips screwdriver
- #3 Phillips screwdriver

Ku-Band 4W BUC Removal

1. Unfasten four (4) #6-32 socket head cap screws on the waveguide flange using a 7/64” hex driver and eight (8) #8-32 Phillips flat head screws on the BUC bracket using a #2 Phillips screwdriver.



2. Remove the BUC from the backplate and unfasten four (4) ¼”-20 Phillips flat head screws from the bracket using a #3 Phillips screwdriver and two (2) #6-32 Phillips flat head cap screws on the waveguide flange using a #2 Phillips screwdriver.



Ku-Band 4W BUC Installation

1. Replace the BUC and fasten the BUC back to the backplate using the tools and fasteners described above. Ensure the waveguides are aligned and fastened before fastening the brackets. Ensure the fasteners are fastened with Loctite. Use Loctite 222 for fasteners under ¼” (6mm) and Loctite 242 for fasteners over ¼” (6mm).

Caution: Align the holes, brackets, and screws carefully to avoid damaging the threads in the BUC housing.

2.4 X-Band BUC Replacement

Replace the X-band BUC in a clean environment.

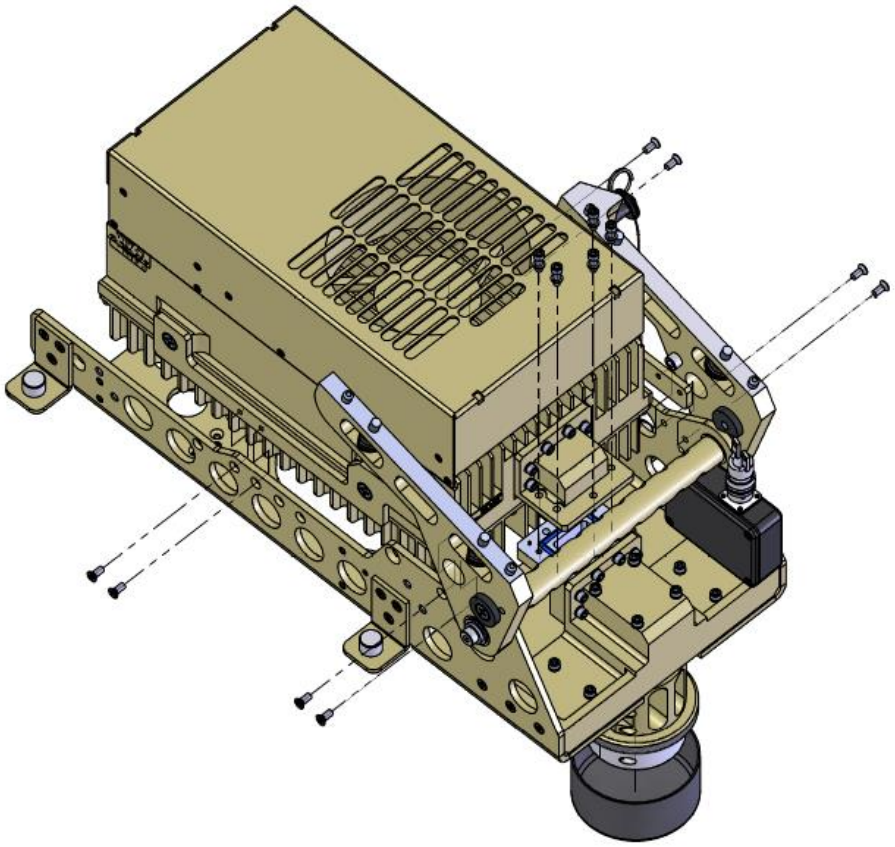
Gray and blue seals are electrically conductive.
Black and red seals are non-conductive.
Using incorrect replacement seals could degrade system operation.

Tools Required

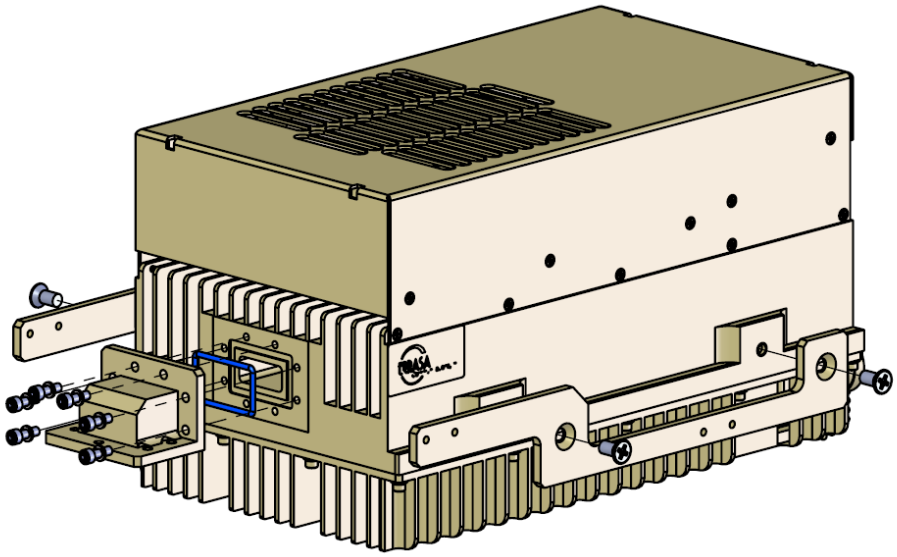
- 9/64-inch Hex Driver (Allen Key) with Spherical Tip
- #2 Phillips screwdriver
- #3 Phillips screwdriver

X-Band BUC Removal

1. Unfasten five (5) #8-32 socket head cap screws on the waveguide flange using a 9/64” hex driver and eight (8) #8-32 Phillips flat head screws on the BUC bracket using a #2 Phillips screwdriver.



2. Remove the BUC from the backplate and unfasten four (4) ¼”-20 Phillips flat head screws from the bracket using a #3 Phillips screwdriver and six (6) #8-32 socket head cap screws on the waveguide flange using a 9/64” hex driver.



X-Band BUC Installation

1. Replace the BUC and fasten the BUC back to the backplate using the tools and fasteners described above. Ensure the waveguides are aligned and fastened before fastening the brackets. Ensure the fasteners are fastened with Loctite. Use Loctite 222 for fasteners under ¼” (6mm) and Loctite 242 for fasteners over ¼” (6mm).

Caution: Align the holes, brackets, and screws carefully to avoid damaging the threads in the BUC housing.

2.5 LNB Replacement

Replace the LNB in a clean environment.

Gray and blue seals are electrically conductive.
Black and red seals are non-conductive.
Using incorrect replacement seals could degrade system operation.

Tools Required

- 3mm Hex driver

LNB Removal

1. Remove the four (4) screws securing the LNB to the boom.
2. Carefully remove the gasket from the LNB.

LNB Installation

1. Install the gasket in the replacement LNB.
2. Install the replacement LNB on the boom with the four (4) screws.

2.6 BBU Replacement

Remove the BBU (Baseband Unit) from the Azimuth Frame in a clean environment.

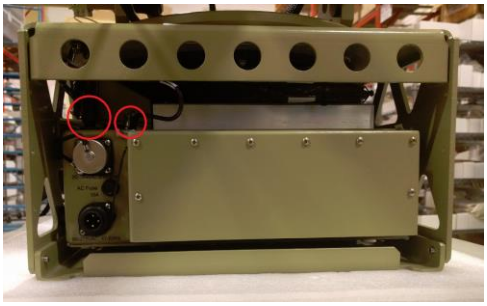
Tools Required

- #3 Phillips screwdriver
- SMA Torque Wrench
- Loctite 242 (Blue/Non-Permanent)

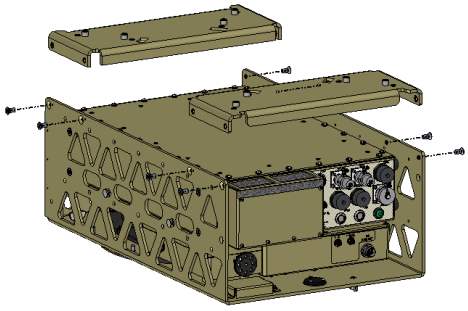
BBU Module Removal

1. From the rear of the Azimuth Frame, disconnect the three cables between the BBU and ACU modules (two coax cables and one multi-conductor cable).

2. From the front of the Azimuth Frame, disconnect the fan and ground cables.



3. On the sides of the Azimuth Frame, remove eight (8) 1/4-20 flathead screws using a #3 Phillips Screw Driver to remove the Leg Brackets.

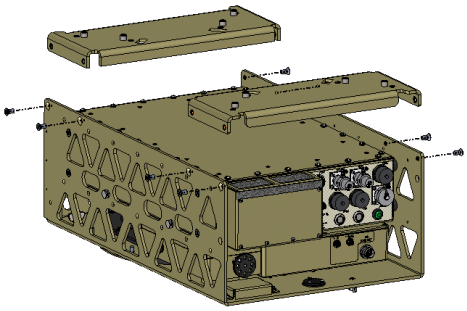


4. On the sides of the Azimuth Frame, remove eight (8) 1/4-20 flathead screws using a #3 Phillips Screwdriver to free the BBU. Lift out the BBU.

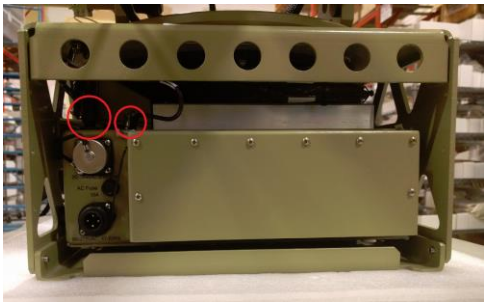
BBU Module Installation

1. Place the Baseband in the chassis and fasten using (8) 1/4-20 flathead screws with Loctite 242 using a #3 Phillips Screw Driver.

2. Install the two leg brackets onto the chassis with (8) 1/4-20 flathead screws with Loctite 242 using a #3 Phillips Screw Driver.



3. From the front of the Azimuth Frame, connect the fan and ground cables.



4. From the rear of the Azimuth Frame, connect the three cables between the BBU and ACU modules (two coax cables and one multi-conductor cable). Use the SMA torque wrench to tighten the SMA connectors to 8 in-lbs.

2.7 ACU Module Replacement

Replace the ACU in a clean environment.

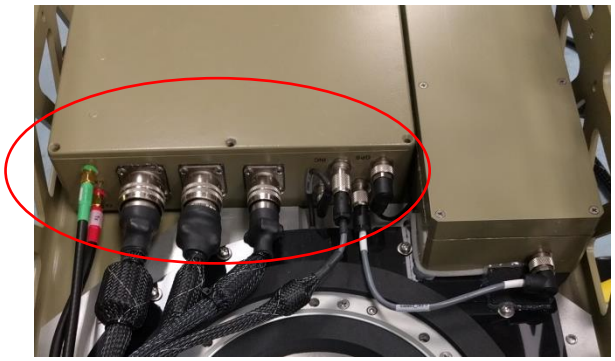
Tools Required

- #2 Phillips screwdriver
- Loctite 242 (Blue/Non-Permanent)
- SMA Torque Wrench

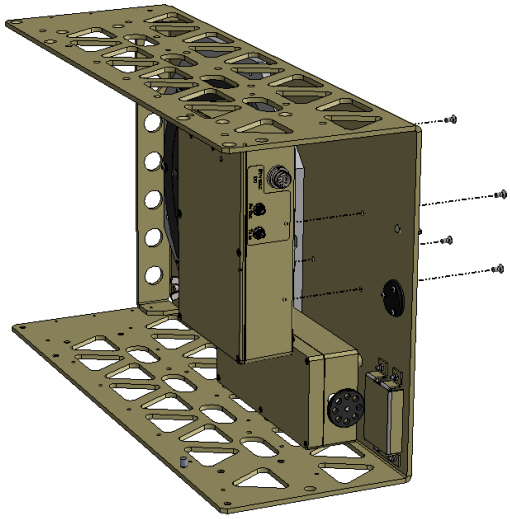
ACU Module Removal

1. Remove the Baseband Unit in according with the Error! Reference source not found. procedure.

2. Disconnect nine (9) cables from the back of the ACU module.



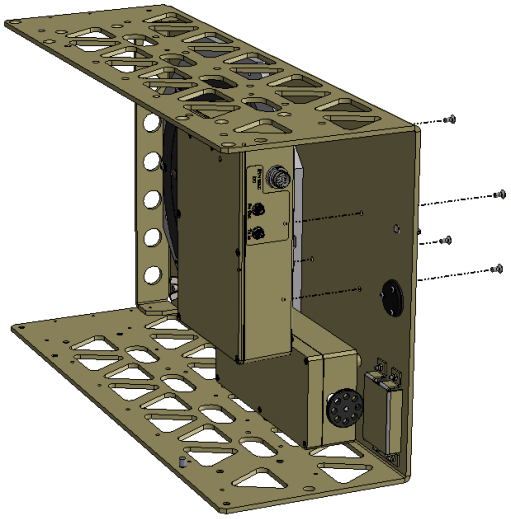
3. Remove four (4) #10-32 x 3/8” flathead screws from the top of the Azimuth Frame. Lift out the ACU.



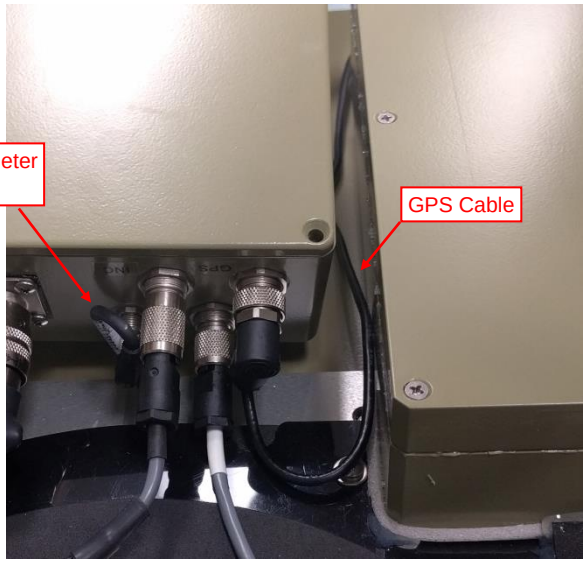
ACU Module Installation

1. Position the replacement ACU module in the Azimuth Frame, aligning the mounting holes.

   Secure the ACU module with the four (4) #10-32 x 3/8” flathead screws from the top of the Azimuth Frame. Use Loctite 242 on the mounting screws.



2. Ensure the GPS cable is routed between the ACU and Gearbox modules. Ensure the Potentiometer Cable Connector is free to connect to the ACU.



3. Connect nine (9) cables to the back of the ACU module.

   Align each unique connector with its respective receptacle carefully. Do not force them. Connect the Green SMA cable to the Rx line and the Red SMA cable to the Tx line.

   Tighten the SMA connectors to 8 in-lbs using the SMA Torque Wrench.

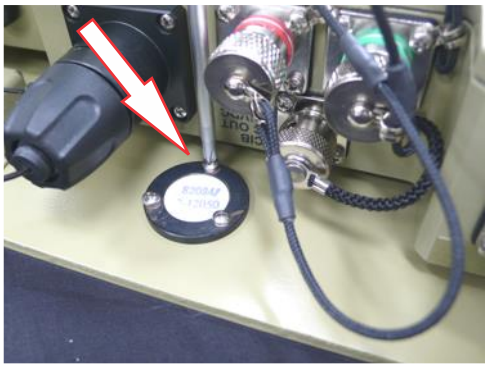
2.8 Bubble Level Replacement

Tools Required

- #1 Phillips screwdriver

Procedure

1. Position the ACU top side down.



2. Remove three (3) screws (4-40 x 5/16”) securing the bubble level.

3. Place the replacement bubble level in position.

   Secure the bubble level with the three screws and lock washers.

2.9 USB Restore

In the event of a drastic field failure it is prudent to take regular snapshots of the system image. This can be saved on a network or remote drive.

Tools Required

- USB Key with recorded image and boot files.
- USB hub with at least 2 free ports.
- USB keyboard.

All data on the system will be replaced with the previously saved image. Ensure that you have saved any files you wish to save before you begin this procedure.

Procedure

1. Connect the USB hub to the USB slot of the GLOBETrekker™.
2. Insert the USB key and the USB keyboard into free ports on the USB Hub.
3. Power on the GLOBETrekker™.
4. Press the Delete key on the USB keyboard to interrupt the boot process and bring up the BIOS.
5. Use the arrow keys to navigate to the **Boot** tab.
6. Set **Boot Option #1** to the entry corresponding to the USB key.
7. Use the arrow keys to navigate to the **Save & Exit** tab.
8. Select **Save Changes and Exit**. The BIOS will exit and the GLOBETrekker™ will reboot.
9. The Restore process will begin automatically and will load the image from the USB stick. Wait for the system to halt.
10. Remove the USB hub from the GLOBETrekker™.
11. Restart the Baseband. The system image will have been replaced with the image saved on the USB stick.

2.10 Satellite Almanac Maintenance

LinkControl maintains a user-editable satellite almanac. This data is used to assist the user in acquiring a satellite and is critical for Auto-Acquisition, as targets for the Satellite are defined by the information in the almanac and the LinkProfile.

To View or Edit the Almanac, select **Tools > Satellite Almanac Tools > Satellite Almanac** from the LinkControl Main Menu.

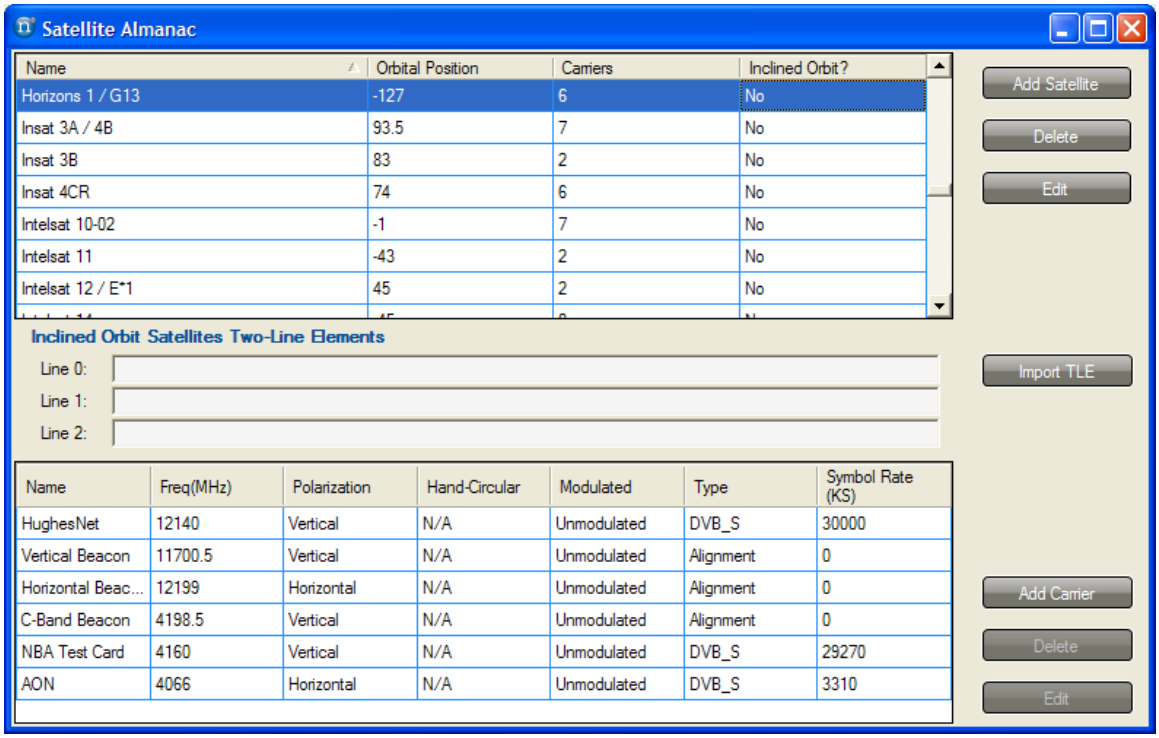


Figure 1: Satellite Almanac

The Satellite Almanac provides a List of Satellites at the top of the interface, with Two-Line Element details for the selected satellite provided below this list. A List of Satellite Carriers is shown below the Two-Line Element fields. Clicking on a satellite in the List of Satellites will populate the List of Satellite Carriers with the Satellite Carriers associated with that satellite.

To add a new satellite:

1. Click on the **Add Satellite** button to the right of the List of Satellites to bring up the Add New Satellite interface:

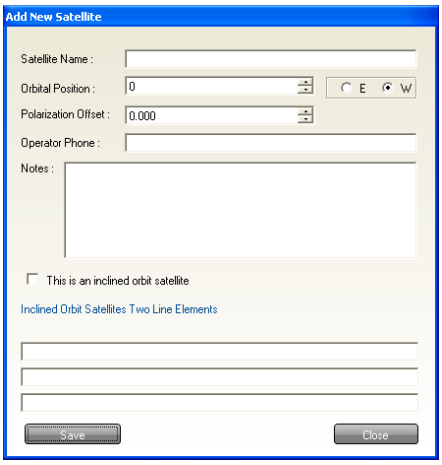


Figure 2: Add New Satellite

2. Enter the name for the satellite in the top data box.

3. Enter the satellite's Orbital Position and Polarization Offset.

4. If the satellite is in an inclined orbit, you must enter the Two Line Element for the satellite:

    a. Select the **This is an Inclined Orbit Satellite** box

    b. Type the NORAD standard Two Line Elements into the two boxes.

    Note: The format of the Two Line Element is rigid and includes a requirement on the number of spaces between each of the numbers. It is advisable that you copy and paste the two line elements from a text file or web page if possible.

5. Click on the **Save** button to add the new satellite to the database.

6. Add any new known carriers on the satellite using the **Satellite Almanac** interface and clicking on the **Add Carrier** button to the right of the List of Satellite Carriers.

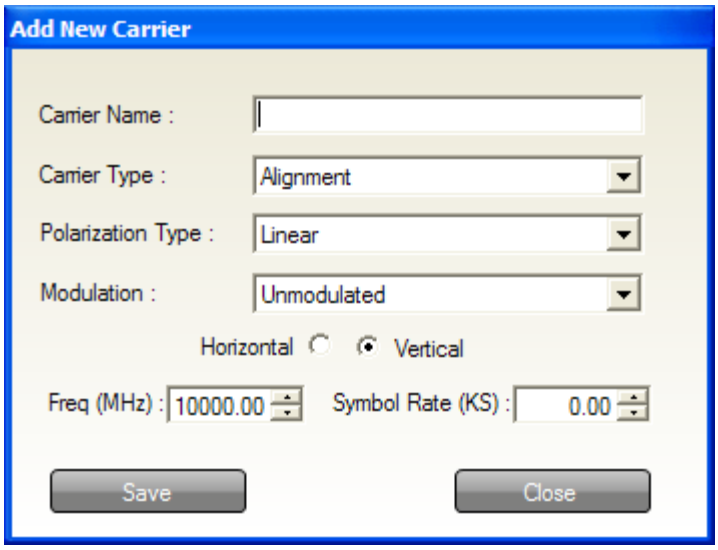


Figure 3: Add/Edit Carrier

a. Enter a name or description for the carrier. This will allow you to identify the carrier when using the spectrum analyzer.

b. Select the **Carrier Type** (alignment or DVB).

c. Enter the receive polarization (vertical, horizontal, left or right) for the carrier.

d. Set the Modulation of the carrier.

e. Enter the frequency for the carrier.

f. Enter the symbol rate for the carrier.

g. Click on the **Save** button.

To edit an existing satellite:

1. Select the satellite in the List of Satellites.
2. Click on the **Edit** button to the right of the List of Satellites.
3. Edit the information in the fields, in the same way as adding a new satellite.
4. Click on the **Save** button to save the changes.

To add or update Two-Line Element information for a satellite using a .tle file:

1. Select the satellite in the List of Satellites.
2. Click on the **Import TLE** button to the right of the Two-Line element fields.
3. Browse for the .tle file and then click on the **Open** button.

To delete an existing satellite:

1. Select the satellite in the List of Satellites.
2. Click on the **Delete** button to the right of the List of Satellites.

Note: Deleting a satellite will delete all of the satellite carriers associated with that satellite as well.

To edit an existing satellite carrier:

1. Select the satellite associated with the satellite carrier in the List of Satellites.
2. Select the satellite carrier in the List of Satellite Carriers.
3. Click on the **Edit** button to the right of the List of Satellite Carriers.
4. Edit the information in the fields, in the same way as adding a new satellite carrier.
5. Click on the **Save** button to save the changes.

To delete an existing satellite carrier:

1. Select the satellite associated with the satellite carrier in the List of Satellites.
2. Select the satellite carrier in the List of Satellite Carriers.
3. Click on the **Delete** button to the right of the List of Satellite Carriers.

Satellite Almanac Tips and Tricks

LinkControl can support any number of entries and we recommend that full advantage be taken of this. Some recommendations:

1. Pick descriptive names that are easy to communicate via phone or voice radio links
2. Populate cross polarization elements in the event of changes in beacons and carriers on your main polarization
3. LinkControl stores these satellites so be aware that secure satellites can be retrieved
4. DVB carriers and beacons may be changed so update your almanac regularly

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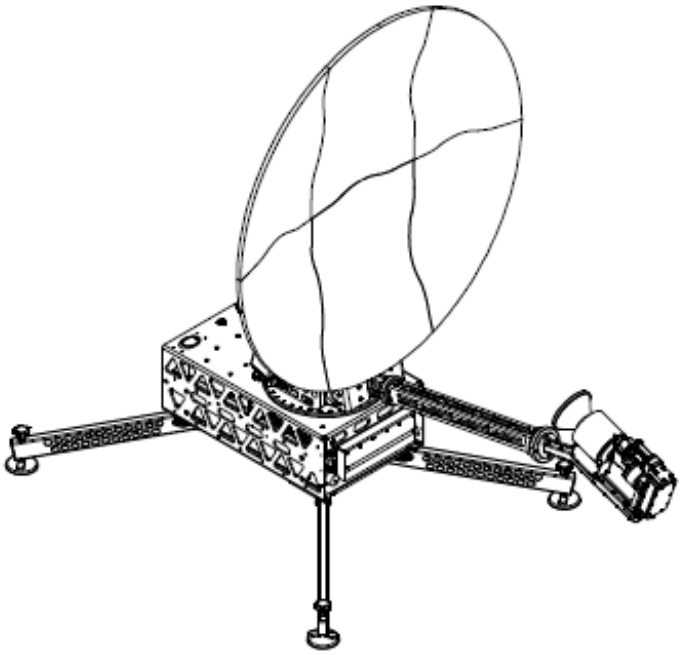

ABOUT NORSAT

Norsat International Inc., founded in 1977, is a leading provider of innovative communication solutions that enable the transmission of data, audio and video for remote and challenging applications. Norsat's products and services include customizable satellite components, portable satellite terminals, maritime solutions and satellite networks. The company's products and services are used extensively by telecommunications services providers, emergency services and homeland security agencies, military organizations, health care providers and Fortune 1000 companies.

110 – 4020 Viking Way | Richmond | British Columbia | Canada

V6V 2L4 | support@norsat.com

www.norsat.com