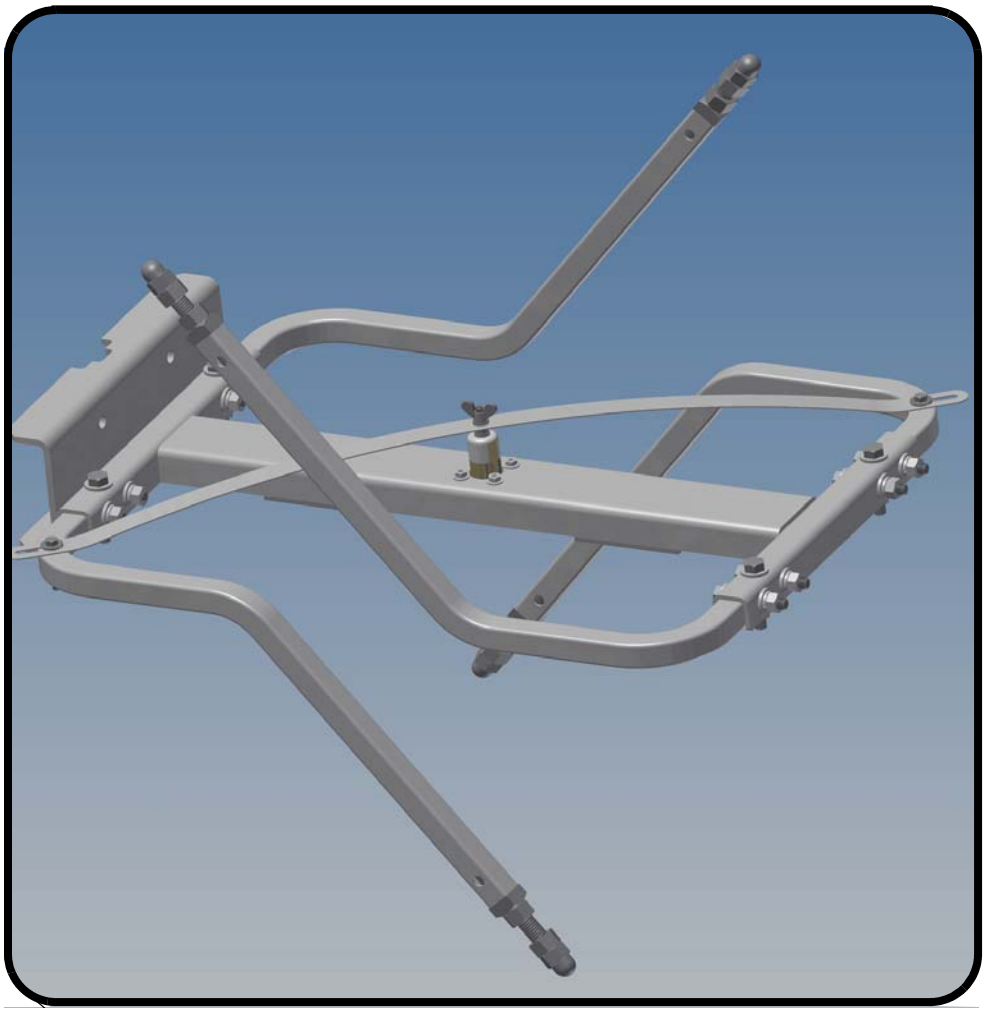
Shively Labs®

Circularly Polarized FM Broadcast Antenna

Versa2une (SLV)
1, 2, & 4-bay, full-wave-spaced



Instruction Manual

Installation, Operation, & Maintenance

Congratulations!

Thank you for purchasing one of the finest FM broadcast antennas on the market today. The Shively Labs Versa2une is the top-of-the-line in its class for its simplicity, superior performance and durability.

Your purchase is backed by the best technical support in the industry. Shively is a leading manufacturer in the broadcast industry, providing an extensive range of antennas, transmission line and components. Our technical staff has a wealth of experience in the broadcast industry and is standing by to serve you in any way.

This manual is intended to give you a good basic understanding of your antenna: its proper and safe installation, startup, and operation, and trouble-shooting and maintenance information to keep it working satisfactorily for years to come. *Please have everyone involved with the antenna read this manual carefully, and keep it handy for future reference.*

Meanwhile, please feel free to contact your sales representative at Shively Labs at any time if you need information or help. Call or write:

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IMPORTANT

Please read this manual in its entirety before beginning installation of your antenna!

Failure to follow the installation and operation instructions in this manual could lead to failure of your equipment and might even void your warranty!

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1 Preparation

Check the shipment.

As soon as you receive your antenna, *BEFORE* signing for the shipment:

a. Check to be sure all the material has arrived.

b. Check for evident damage to any of the boxes.

c. If any boxes are missing, or if any are obviously damaged, describe the problem in a WRITTEN note on the shipping papers BEFORE signing them. Then call Shively right away, and we'll do everything we can to correct the situation.

Important!

Never store the antenna system outdoors, boxed or otherwise. Take pains to keep the antenna components dry. You will need to purge moisture from the interior of the antenna components before applying transmitter power, and purging will be much more time-consuming if the components get wet.

Torque specifications.

NOTE

Use an anti-seize compound to minimize galling on stainless steel threads.

Table 1. Torque specifications

Hardware size	Torque (dry)	Torque (lubricated)
M5 stainless steel	3.75 lb-ft (0.52 kg-m)	3.4 lb-ft (0.47 kg-m)
M8 stainless	16 lb-in (2.2 kg-m)	14 lb-ft (1.9 kg-m)
M12 stainless	54 lb-ft (7.5 kg-m)	48 lb-ft (6.6 kg-m)
Antenna input fitting	18 - 22 lb-in (21 - 25 cm-kg)	n/a

Check the parts.

Check to be sure all the parts shown in Table 2 on page 47 have arrived in good condition.

NOTE

Item callouts are consistent across all the illustrations in this technical sheet.

Prepare the mounting location.

Figure 1. Tower layout, single-bay antenna

Remember!

It is YOUR responsibility to ensure that your installation meets all applicable codes and the centerline-of-radiation requirements of your FCC construction permit.

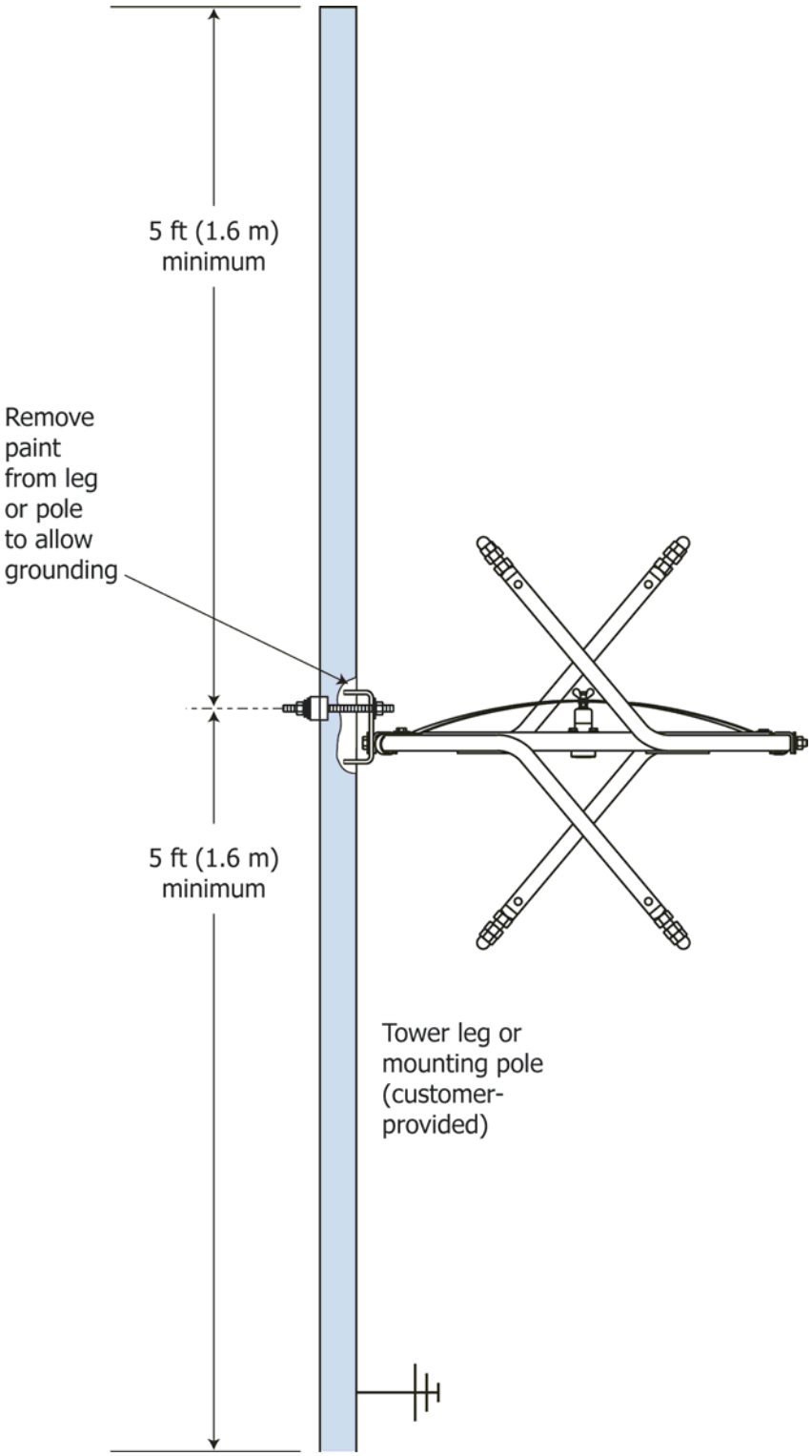


Figure 2. Tower layout, two-bay antenna

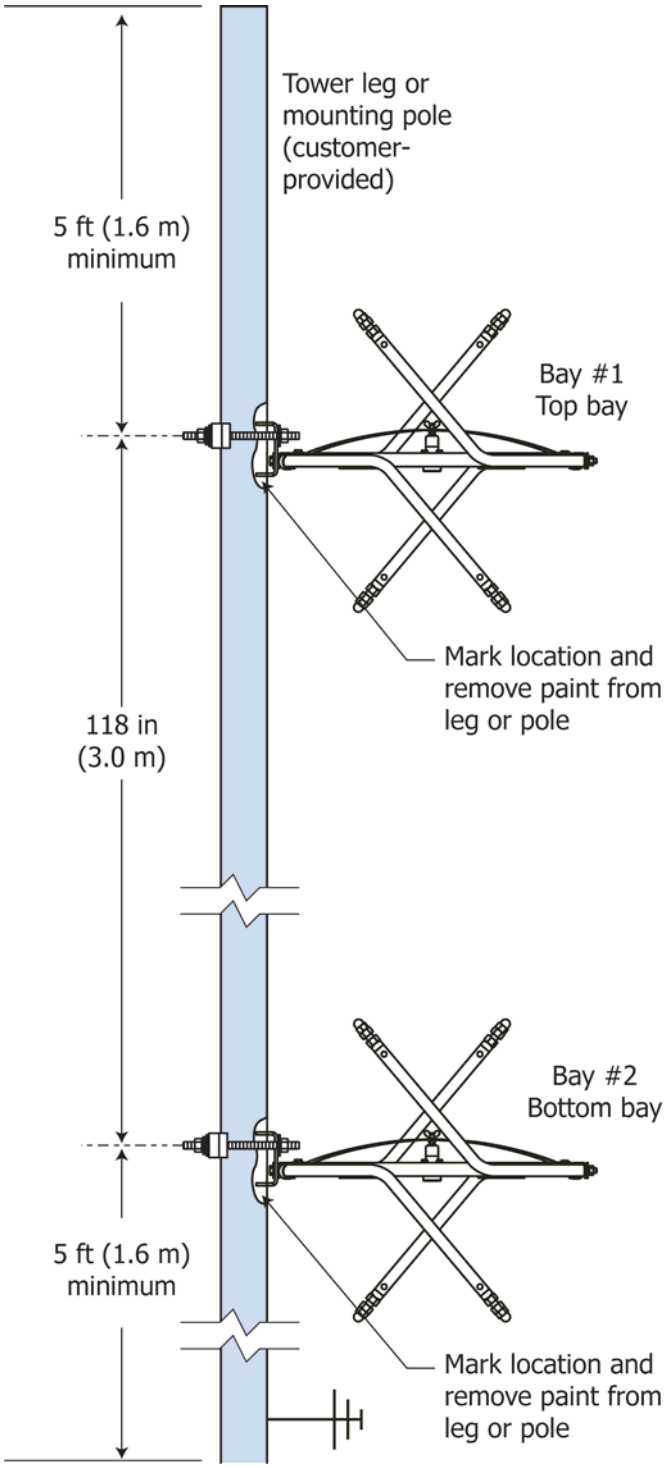
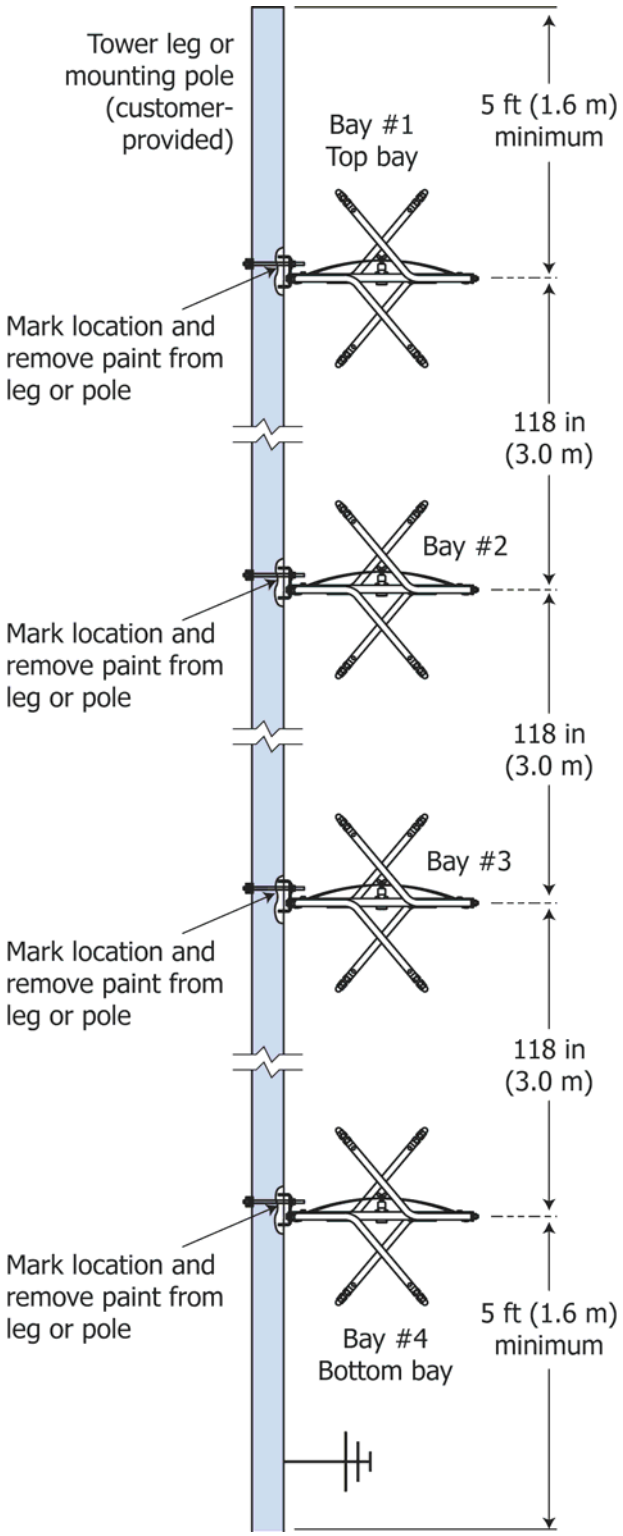


Figure 3. Tower layout, four-bay antenna



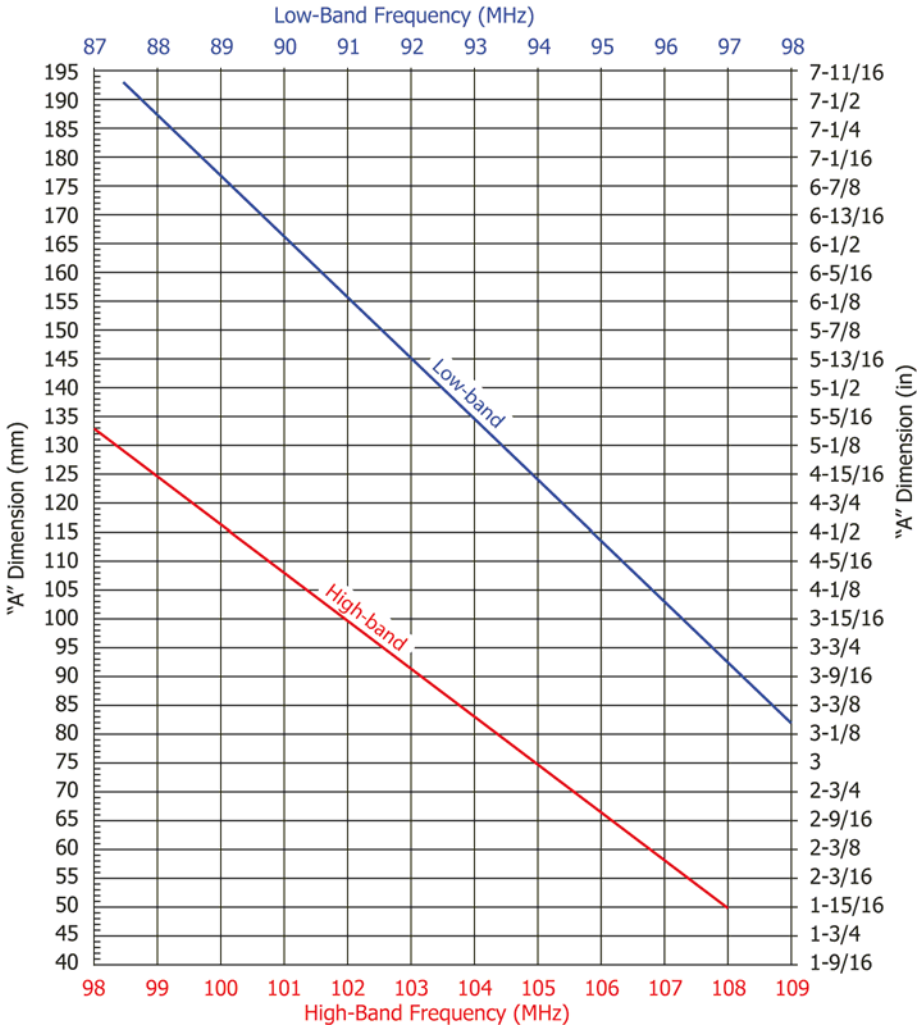
High-band or low-band?

87.5 - 98 MHz = Low-band

98.1 - 108 MHz = High-band.

Determine "A" dimension.

Figure 4. Low-band and high-band "A" dimension values

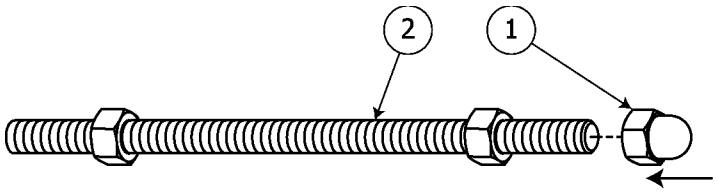


2 Arm Assembly

Assemble arms.

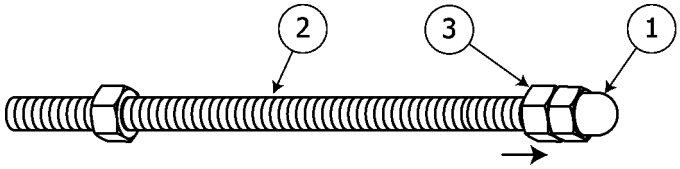
a. Screw the acorn nut (Figure 5, 1) onto the 230 mm threaded rod (2) as far as it will go.

Figure 5. Arm assembly a



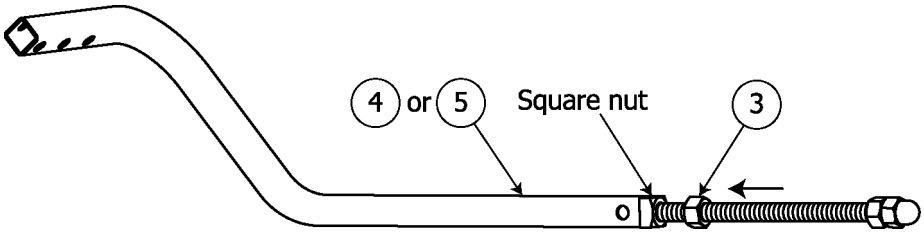
b. Screw a M12 hex nut (Figure 6, 3) tightly against the acorn nut.

Figure 6. Arm assembly b



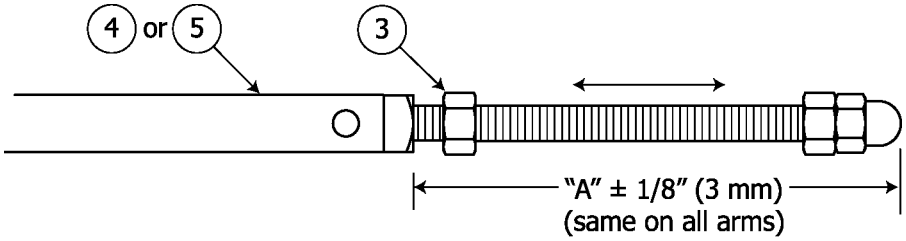
c. Insert the threaded rod into the arm (Figure 7, 4 or 5).

Figure 7. Arm assembly c



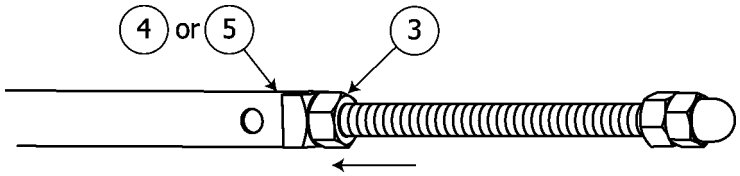
d. (Figure 8) Set the "A" dimension (from Figure 4) to a tolerance of ± 1/8" (3 mm).

Figure 8. Arm assembly d



e. (Figure 9)Screw the hex nut against the square nut at the end of the arm to secure the threaded rod and the "A" dimension.

Figure 9. Arm assembly e



f. (Figure 10) Repeat for the other 3 arms.

Figure 10. Arm assembly - complete

3 Bay Assembly (without radomes)

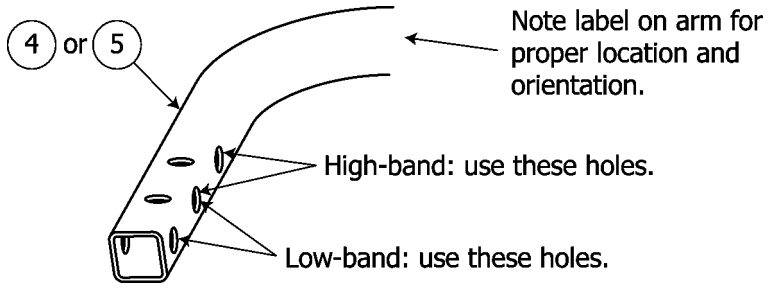
Attach the arms to the radiator.

NOTE

This step may be made easier by clamping the radiator to a surface or mounting it temporarily on a vertical pole.

a. (Figure 11) Identify the mounting holes to be used.

Figure 11. Arm hole selection

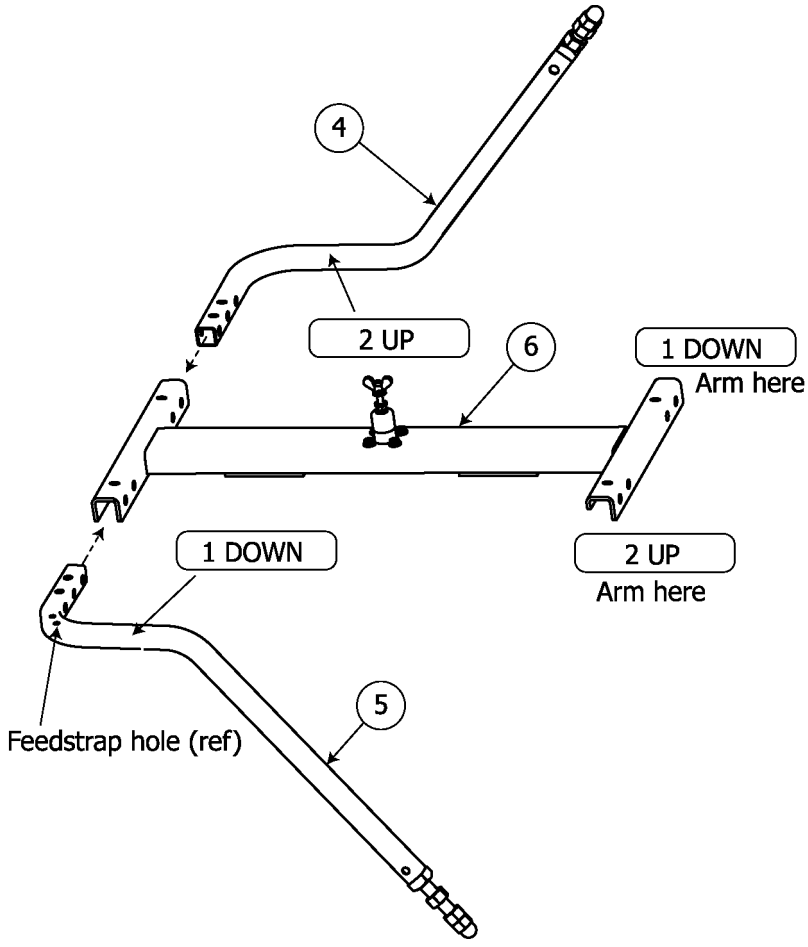


CAUTION

Parts 5, with the feedstrap mounting holes, must be mounted diagonally across from each other as shown.

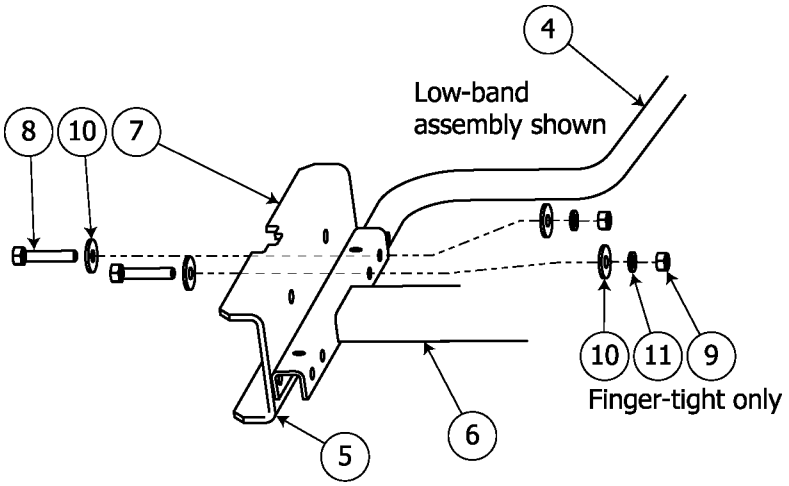
b. Position the first arms (Figure 12, 4 and 5) on the radiator (6).

Figure 12. Position first arms



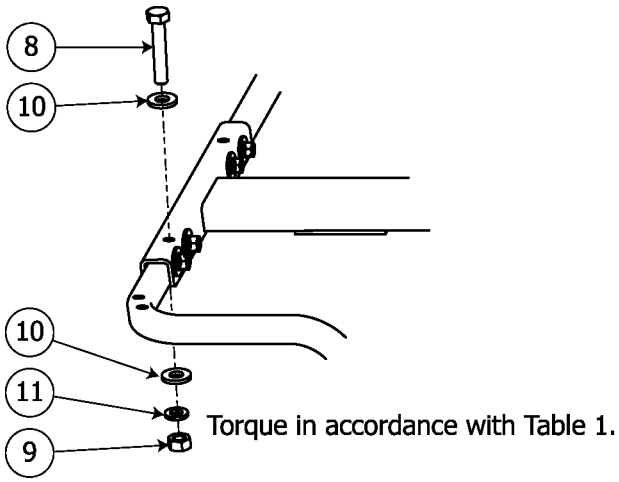
c. Attach the channel mount (Figure 13, 7) and arms, using M8 hardware (8, 9, 10, and 11), finger-tight only.

Figure 13. Channel attachment



d. Secure each arm with a vertical M8 bolt and hardware (Figure 14, 8, 9, 10, and 11). Torque in accordance with Table 1 on page 1.

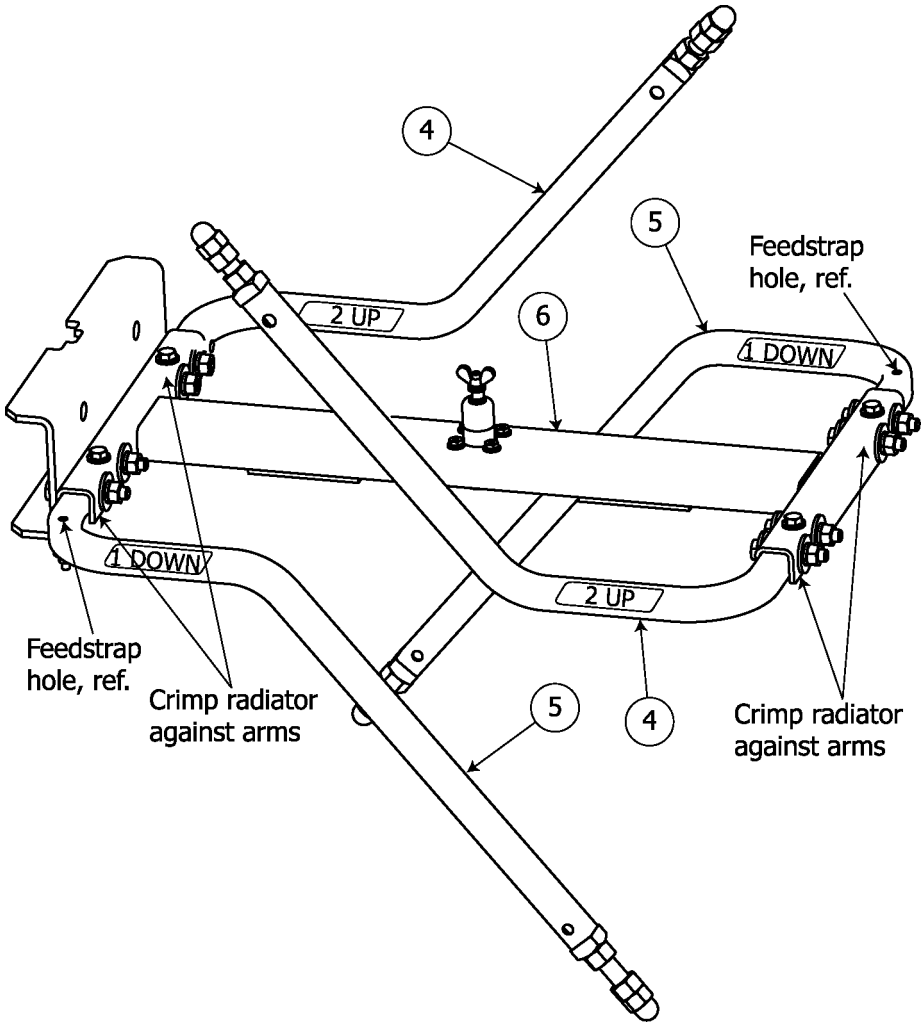
Figure 14. Vertical bolts



e. Tighten the nuts on the horizontal bolts. Torque in accordance with Table 1.

f. Repeat to attach the other two arms in their correct positions (Figure 15).

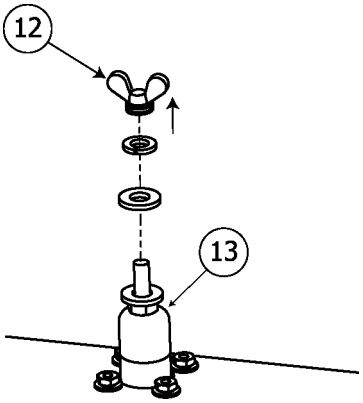
Figure 15. Arm attachment - complete



Install the feedstrap.

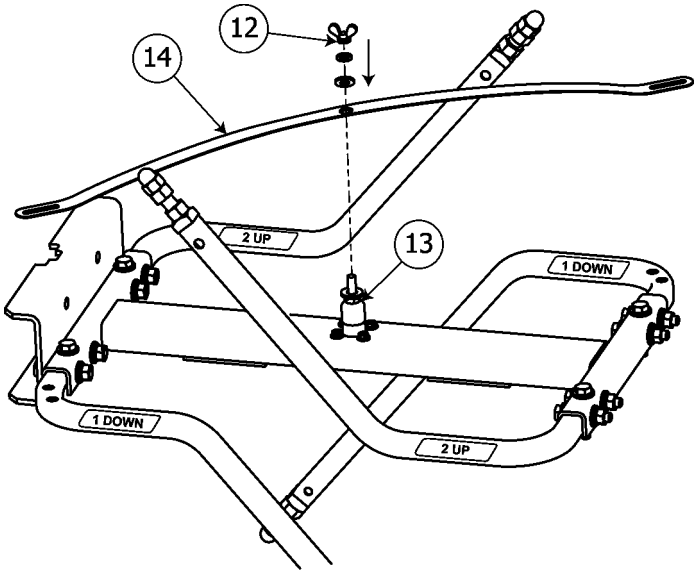
a. Remove the wingnut (Figure 16, 12), the top lockwasher, and the topmost flat washer from the endseal (13). Leave the second flat washer in place.

Figure 16. Remove wingnut



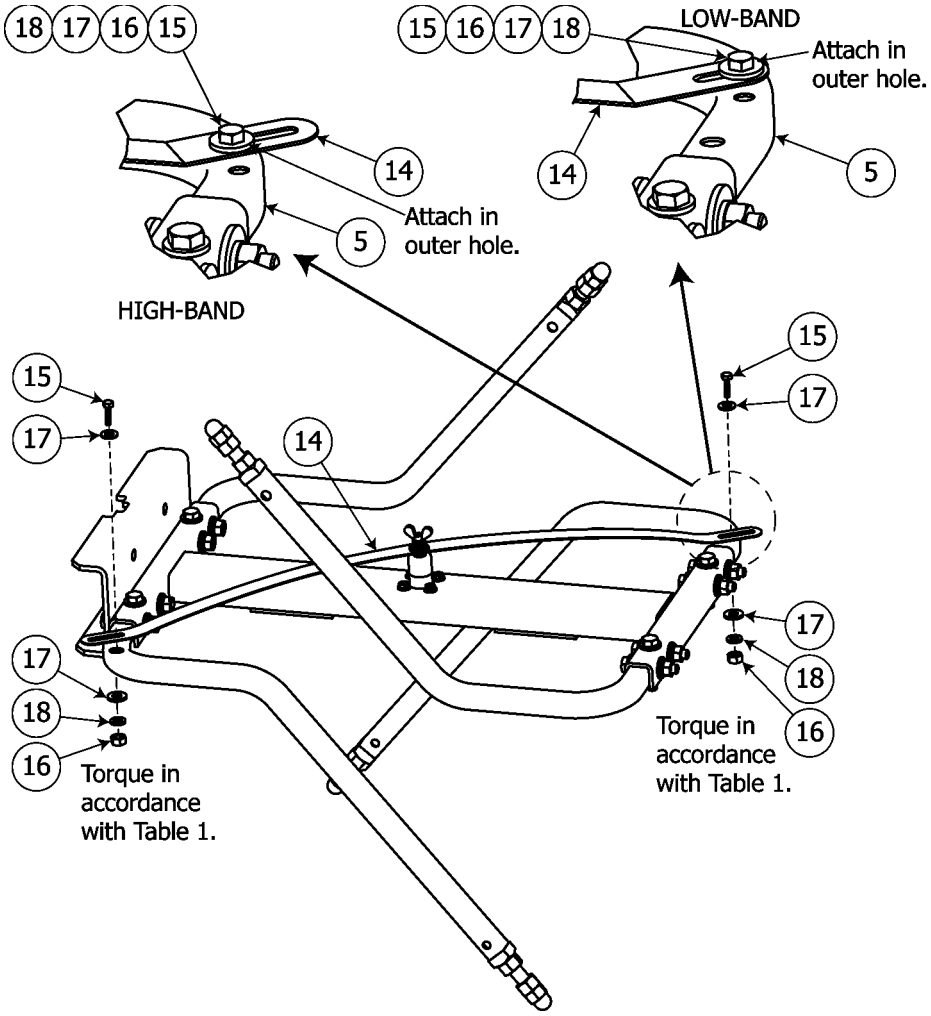
b. Secure the feedstrap (Figure 17, 14) to the endseal.

Figure 17. Feedstrap to endseal



c. Using the M5 hardware (Figure 18, 15, 16, 17, and 18), secure the feedstrap to the arms.

Figure 18. Feedstrap to arms



Connect the coax cable.

CAUTION

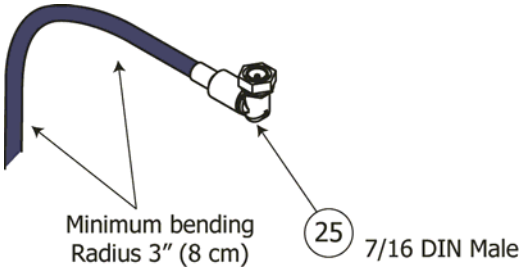
Stressing a coax connection after assembly can detune the system. Therefore, never make a connection and then bend or twist the cable, or use the connector to force the coax into shape. Form the cable first, then attach it to the connector.

CAUTION

The minimum bending radius for 1/2" coax is 3" (8 cm). Do not bend it too tightly; you may damage it.

a. Form the cable (Figure 19, 24) to the desired shape.

Figure 19. Form coax cable

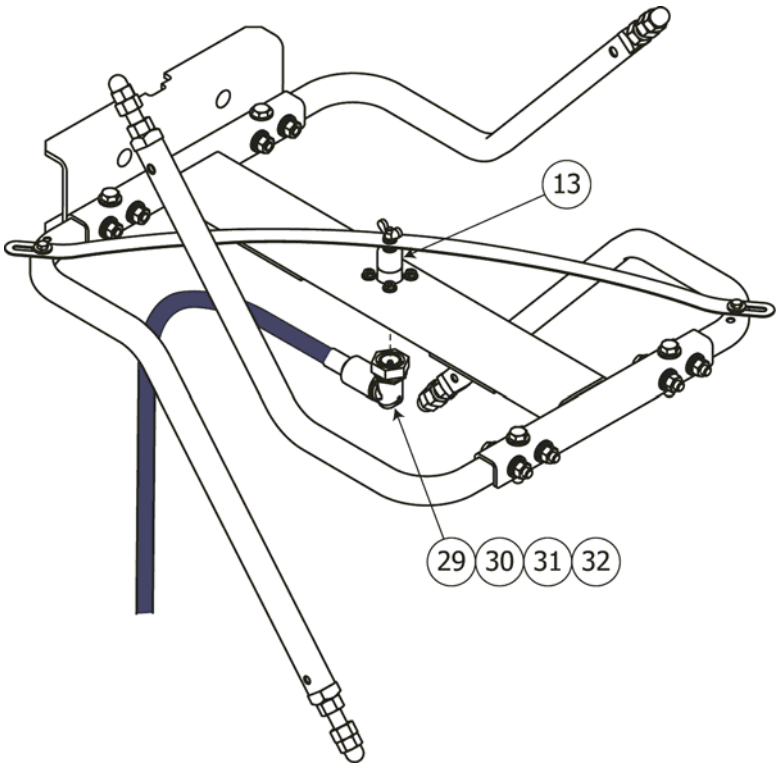


CAUTION

Do not overtighten the connectors. Overtightening may damage them.

b. (Figure 20) Attach the elbow on the cable to the antenna input. Torque to 18 - 22 lb-in (21 - 25 kg-cm).

Figure 20. Attach coax cable to antenna input



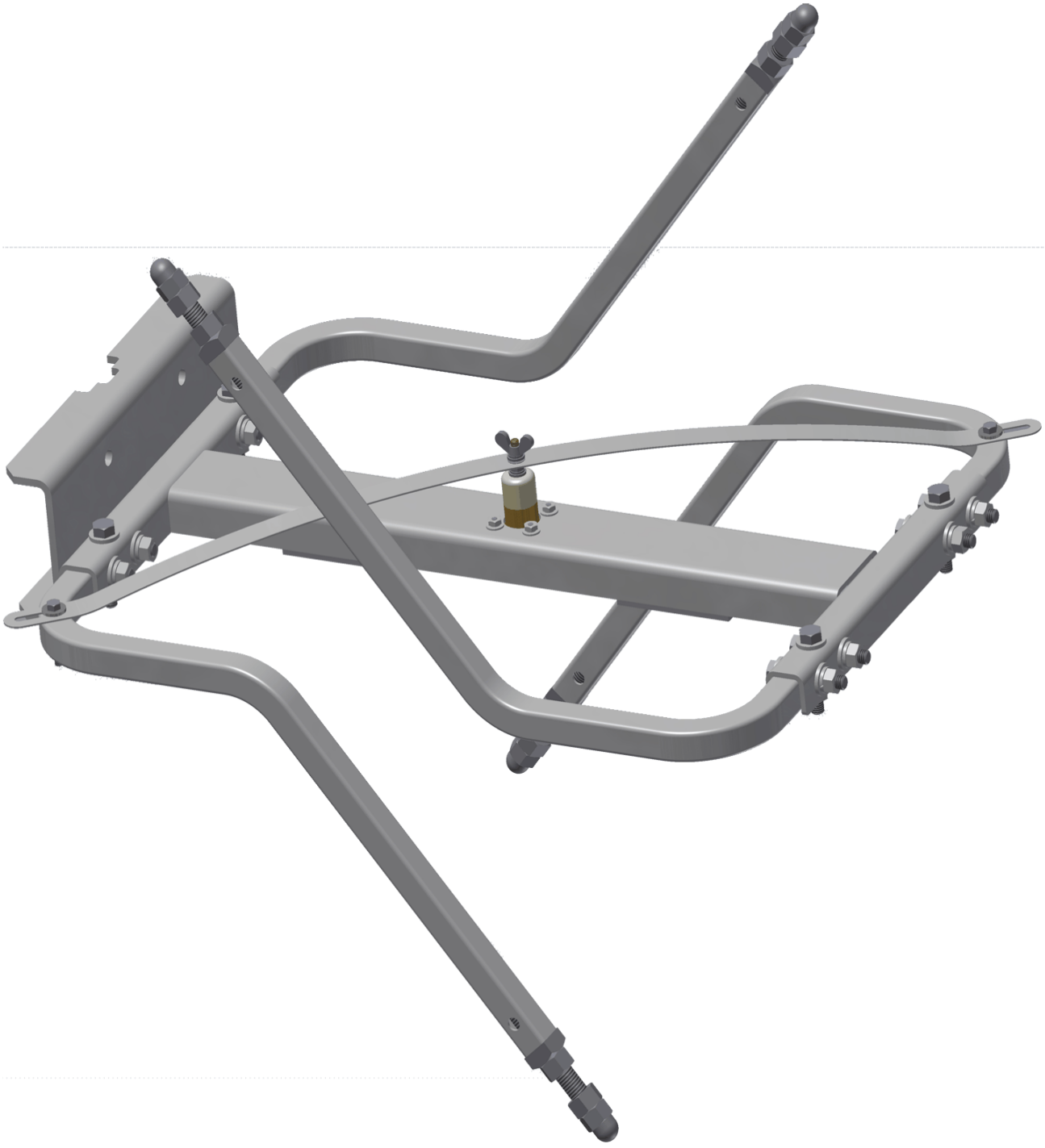
c. Seal the joint thoroughly with splice tape (26).

This completes assembly of your antenna bay without radomes (Figure 21 on page 16).

If your antenna has multiple bays, repeat this chapter for the remaining bays.

Then please proceed to Mounting the Antenna Bay(s) on page 27.

Figure 21. Finished antenna bay assembly



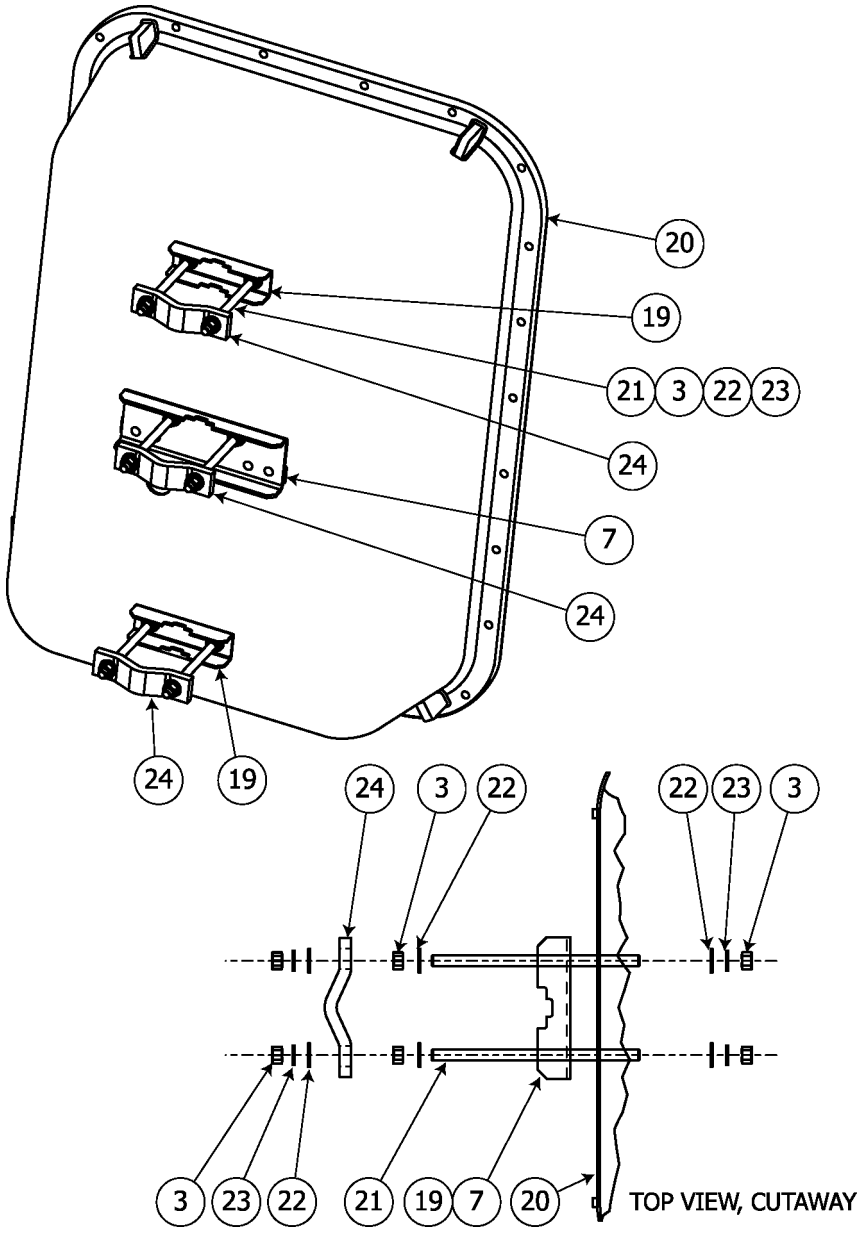
4 Bay Assembly (with radomes)

Attach the mount channels to the radome back half.

a. Attach a center channel mount (Figure 22, 7) and two end channel mounts (19) to the radome back half (20), using the threaded rods (2) and M12 hardware (3, 21, 22) as shown.

b. Loosely attach the clamp halves (23) to the threaded rods.

Figure 22. Mount channels and clamp halves to radome



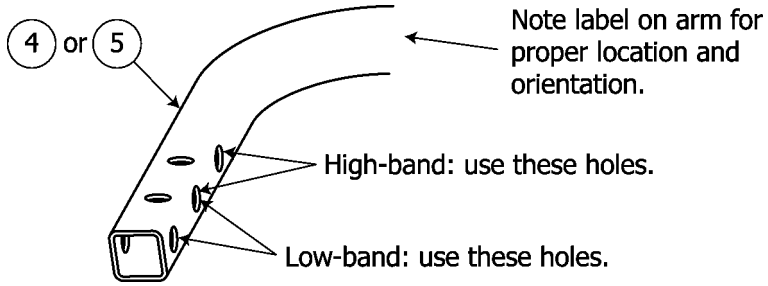
Attach the arms to the radiator.

NOTE

This step may be made easier by clamping the radiator to a surface or mounting it temporarily on a vertical pole.

a. (Figure 23) Identify the mounting holes to be used.

Figure 23. Arm hole selection

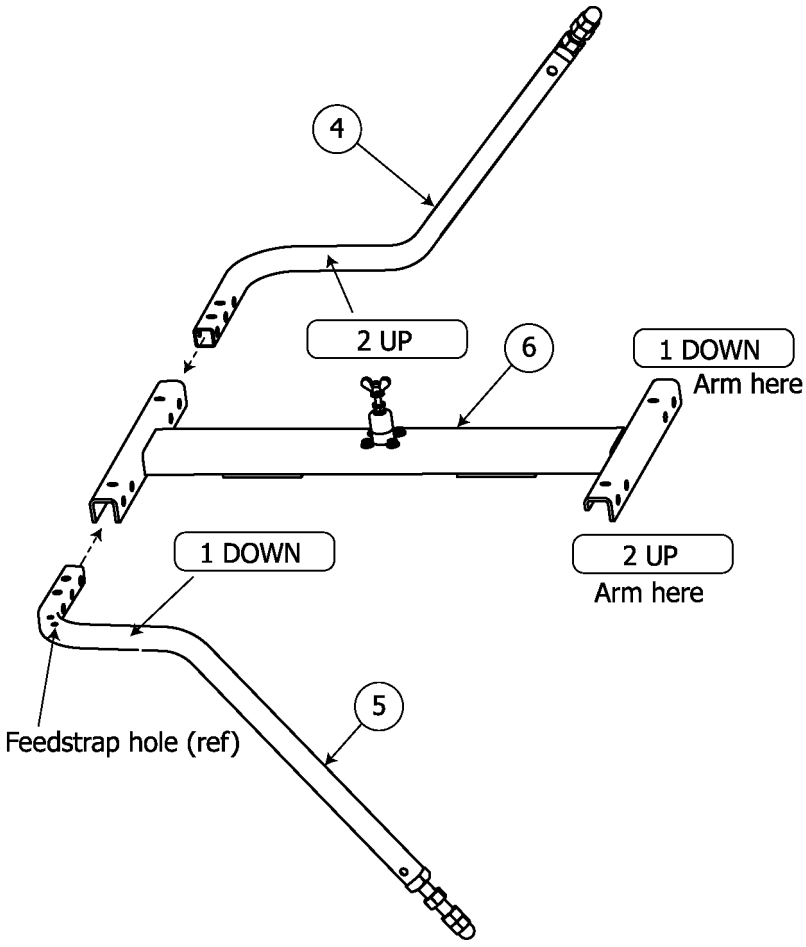


CAUTION

Parts 5, with the feedstrap mounting holes, must be mounted diagonally across from each other as shown.

b. Position the inner arms (Figure 24, 4 and 5) on the radiator (6).

Figure 24. Position inner arms



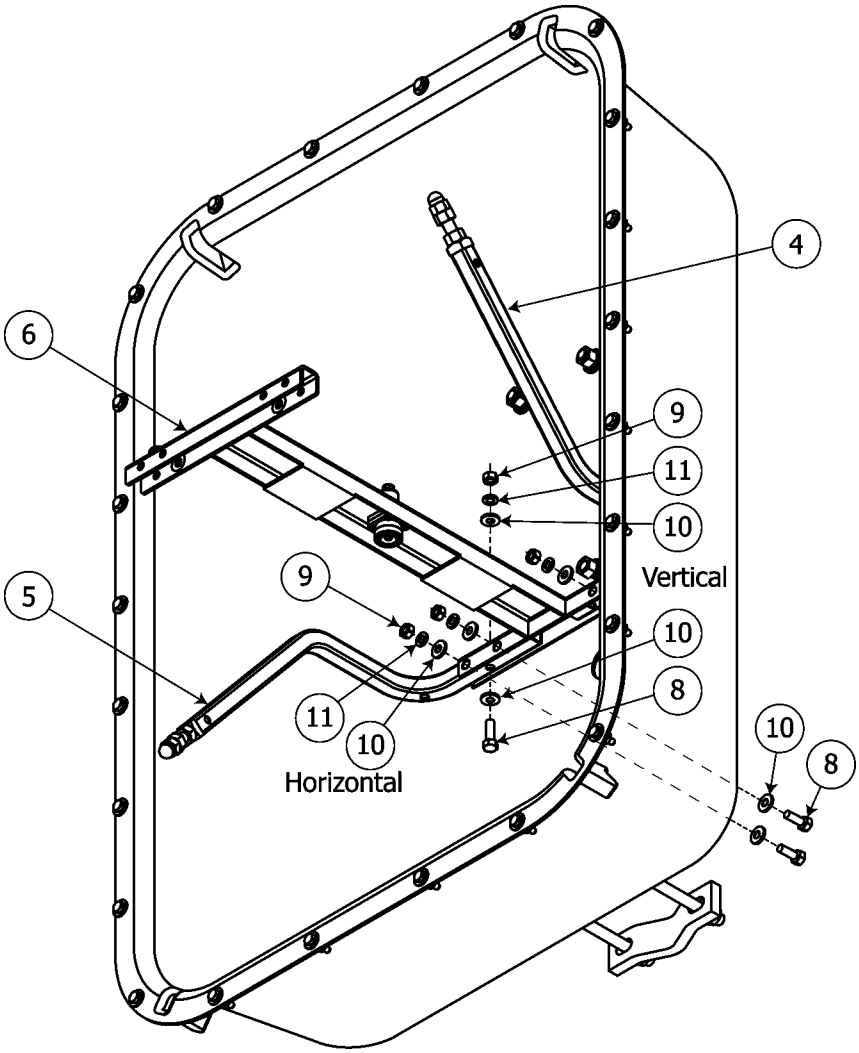
c. Attach the radome assembly (assembled above) and the inner arms (Figure 25, 4 and 5) to the radiator (6), using M8 hardware (8, 9, 10, and 11), finger-tight only.

NOTE

The channel of the radiator fits into the rectangular slot in the back of the radome half.

d. Secure each arm with a vertical M8 bolt and hardware (8, 9, 10, and 11). Torque in accordance with Table 1 on page 1.

Figure 25. Radome, inner arms to radiator



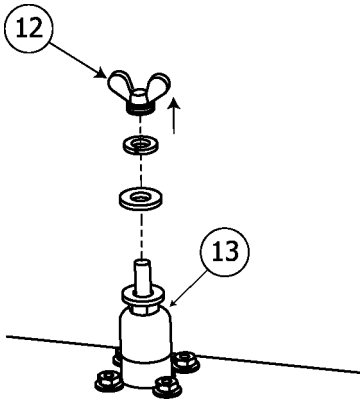
e. Tighten the nuts on the horizontal bolts (Figure 25). Torque in accordance with Table 1.

f. Repeat to attach the other two arms in their correct positions.

Install the feedstrap.

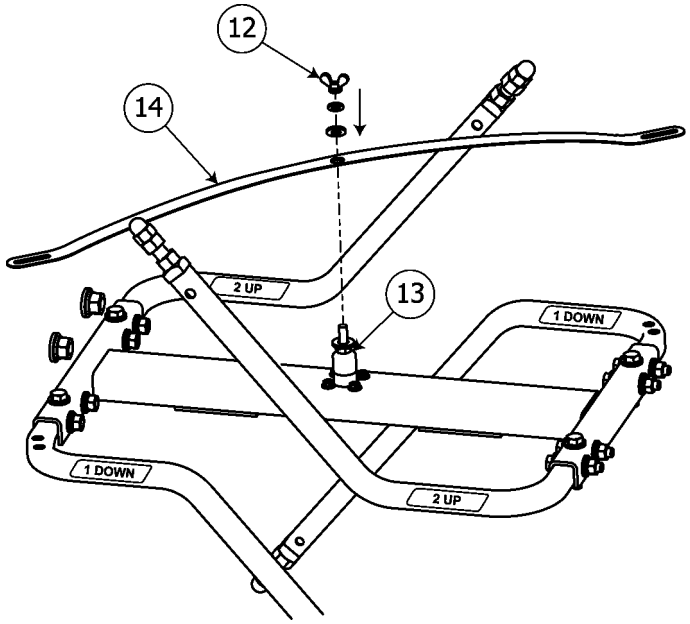
a. Remove the wingnut (Figure 26, 12), the top lockwasher, and the topmost flat washer from the endseal (13). Leave the second flat washer in place.

Figure 26. Remove wingnut



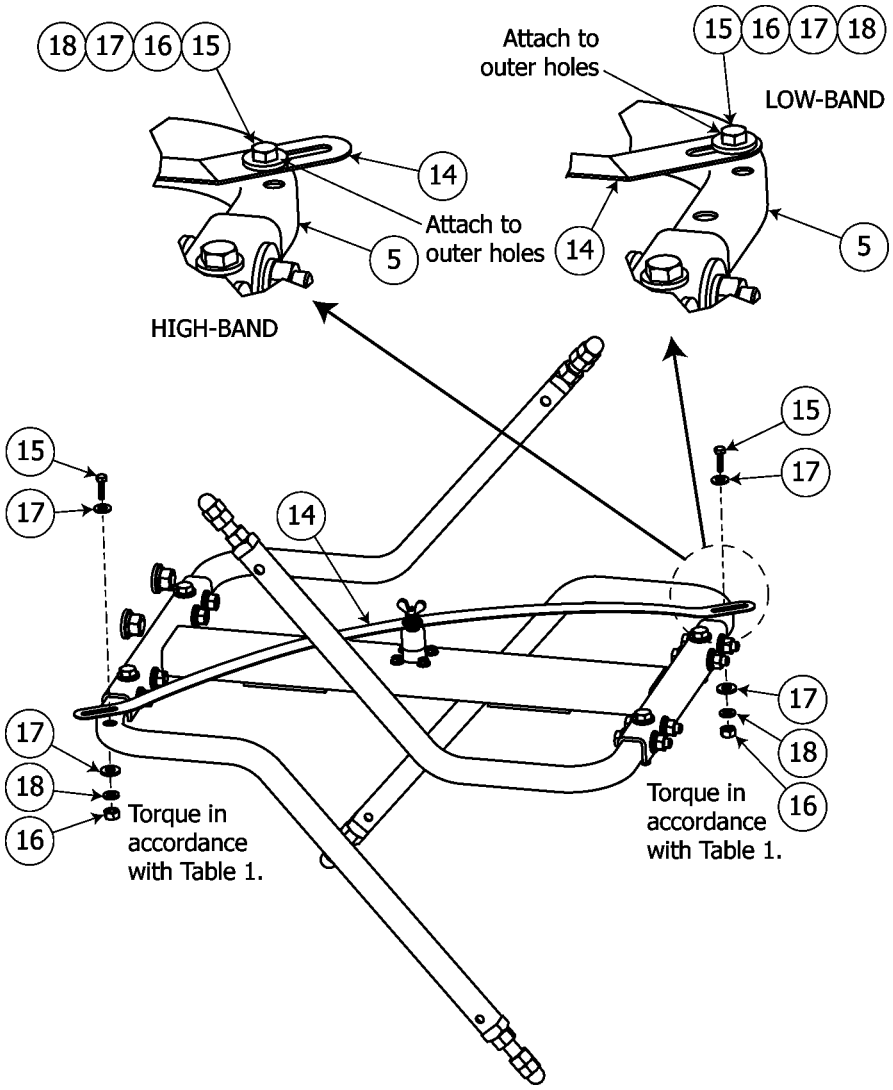
b. Using the wingnut, secure the feedstrap (Figure 27, 14) to the endseal.

Figure 27. Feedstrap to endseal



c. Using the M5 hardware (Figure 28, 15, 16, 17, and 18), secure the feedstrap to the arms.

Figure 28. Feedstrap to arms



d. (High-band only) Bend the ends of the feedstrap down over the arms to allow clearance inside the radome (Figure 29).

Figure 29. Feedstrap ends bent down

Attach the coax cable.

CAUTION

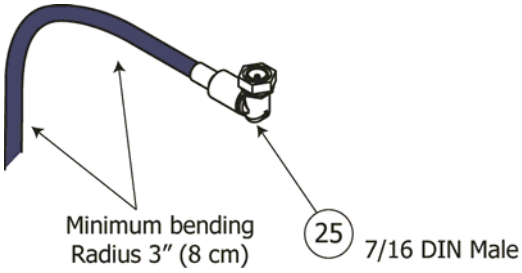
Stressing a coax connection after assembly can detune the system. Therefore, never make a connection and then bend or twist the cable, or use the connector to force the coax into shape. Form the cable first, then attach it to the connector.

CAUTION

The minimum bending radius for 1/2" coax is 3" (8 cm). Do not bend it too tightly; you may damage it.

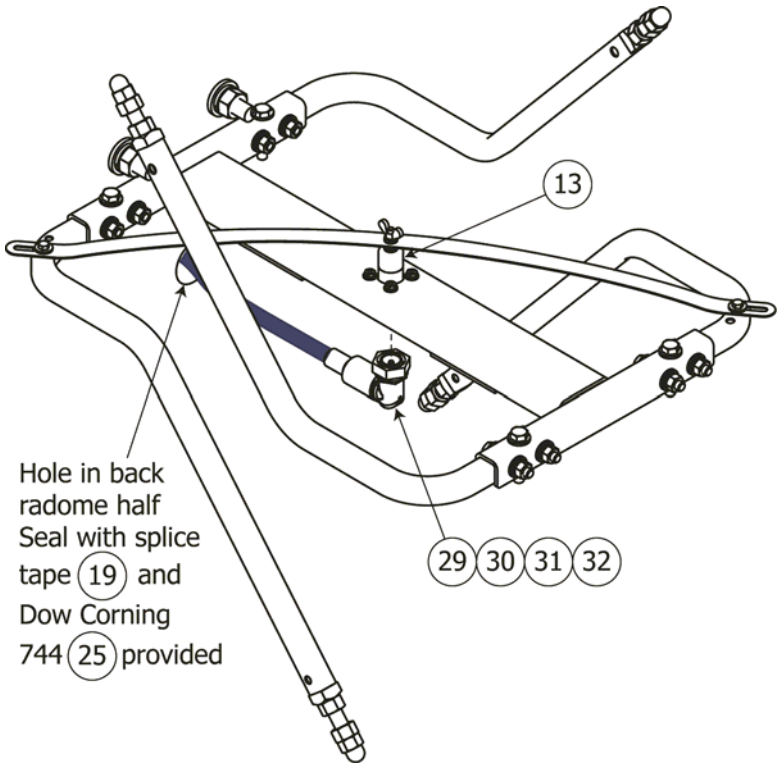
a. Form the cable (Figure 30, 24) to the desired shape.

Figure 30. Form coax cable



b. Insert the elbow end of the coax feedline cable (Figure 31, 24) in through the round hole in the back of the radome half (20), and connect it to the base of the endseal (13). Torque the cable fitting in accordance with Table 1 on page 1.

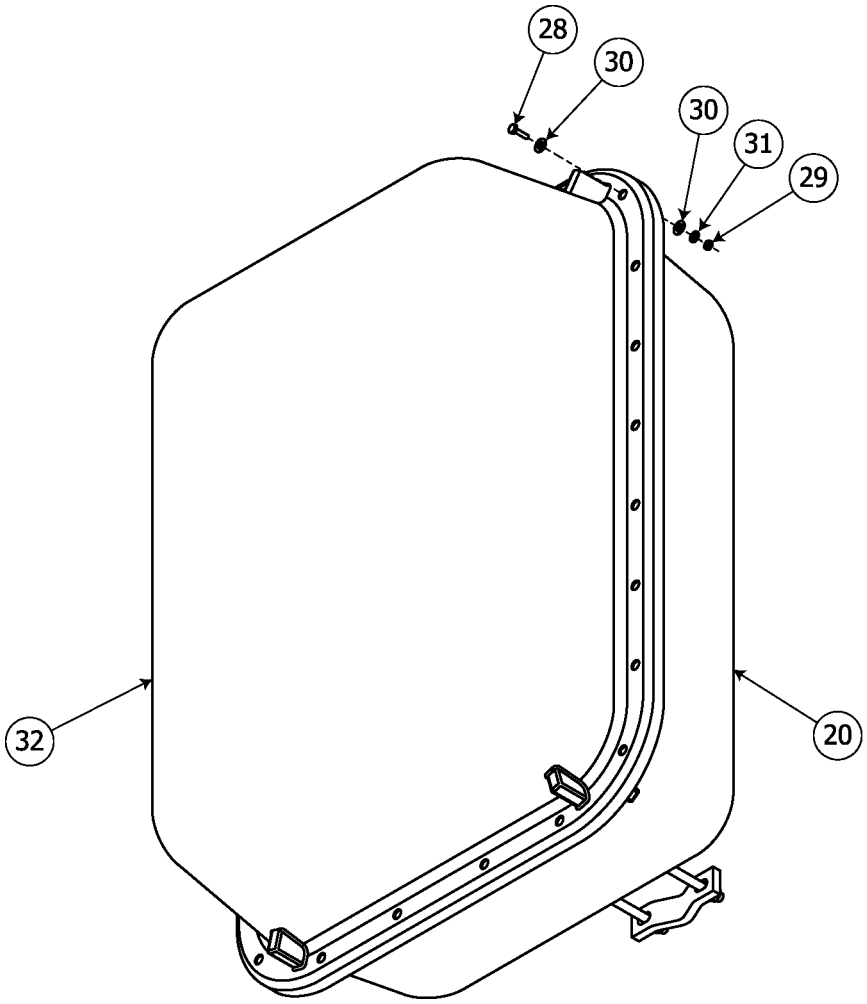
Figure 31. Attach coax cable to antenna input.



Install the radome front half.

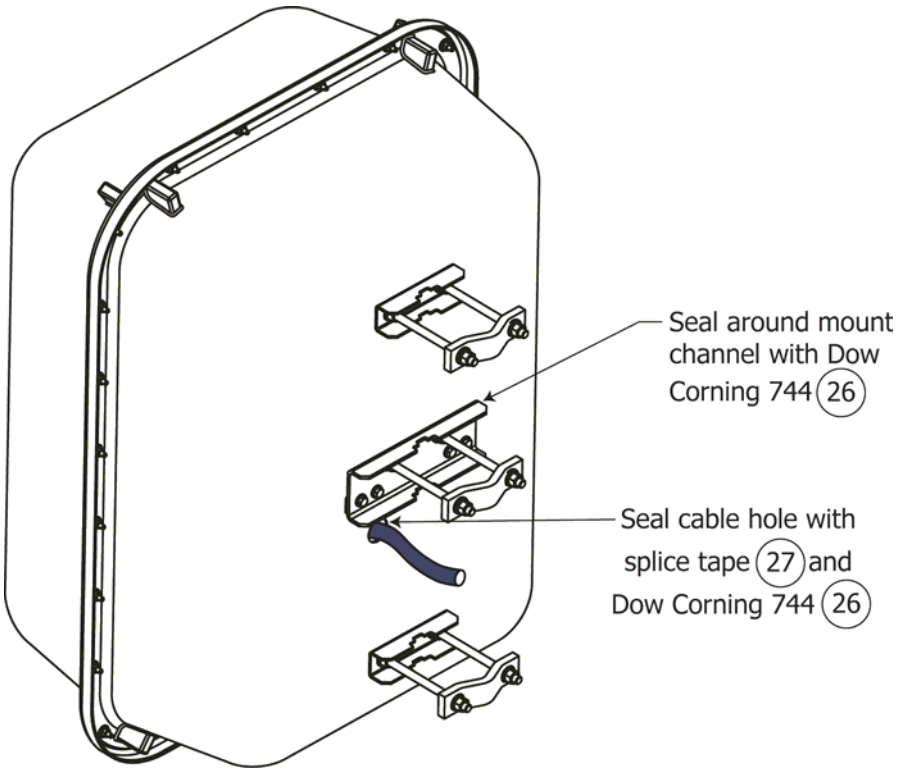
Figure 32. Radome front half installation

a. Using the 1/4" hardware (Figure 32, 27), attach the radome front half (28) to the radome back half (20).



b. Using splice tape (Figure 33, 26, provided with the antenna) and Dow Corning 744 adhesive-sealant (25), seal:
    - The perimeter of the center mount channel on the back of the radome, and
    - The hole in the radome back half around the coax cable.

Figure 33. Seal around radome openings.



This completes assembly of your antenna bay with radomes (Figure 34 on page 26).

If your antenna has multiple bays, repeat this chapter for the remaining bays.

Then please proceed to Mounting the Antenna Bay(s) on page 27.

Figure 34. Finished antenna bay assembly with radome, back view

5 Mounting the Antenna Bay(s)

Mount the antenna bay on the tower leg or pole.

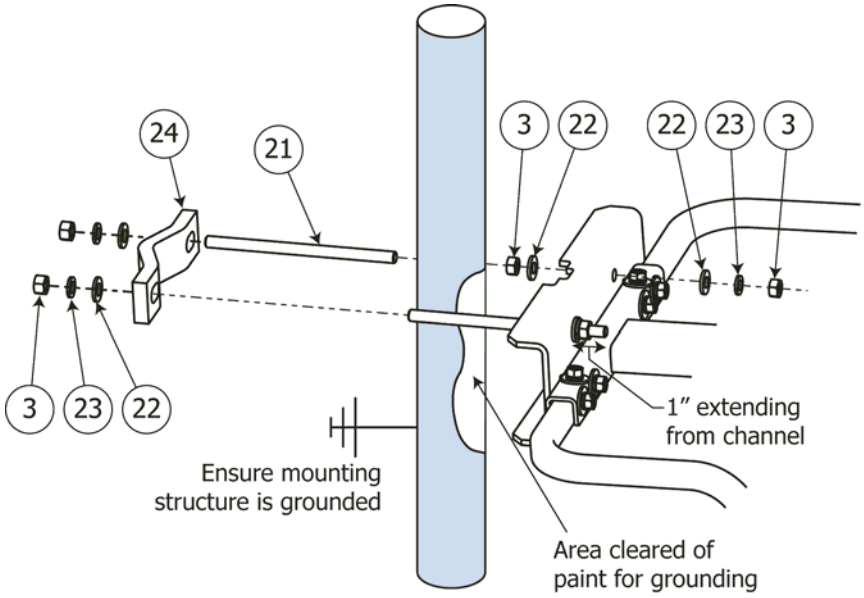
NOTE

If the supporting structure is non-metallic (for example, a chimney or a tree), run a ground cable (customer-supplied) from the antenna mount to a post driven into the ground.

a. Using the M12 hardware (Figure , 3, 21, 22), secure the threaded rods (2) to the mount channel, with the end of the threaded rod extending approximately one inch beyond the surface of the channel, as shown.

b. Then use the threaded rods with M12 hardware and clamp half (23) to clamp the antenna to the tower leg or pole at the location you marked and cleared of paint. Do not tighten fully at this time.

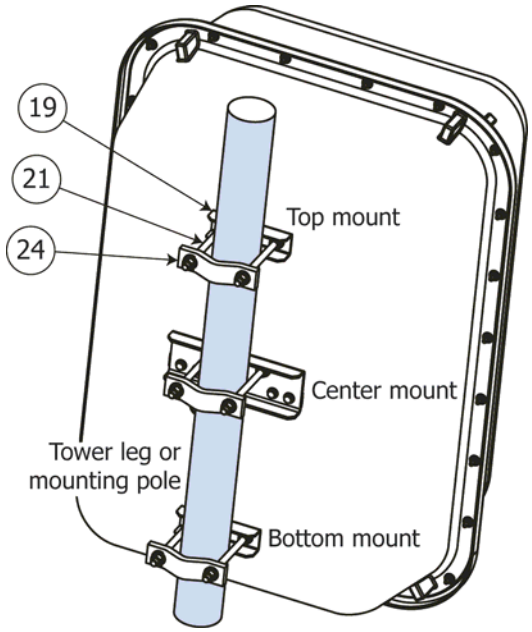
Figure 35. Mount the antenna bay(s).



Bay without radome shown. Radome bay is similar.

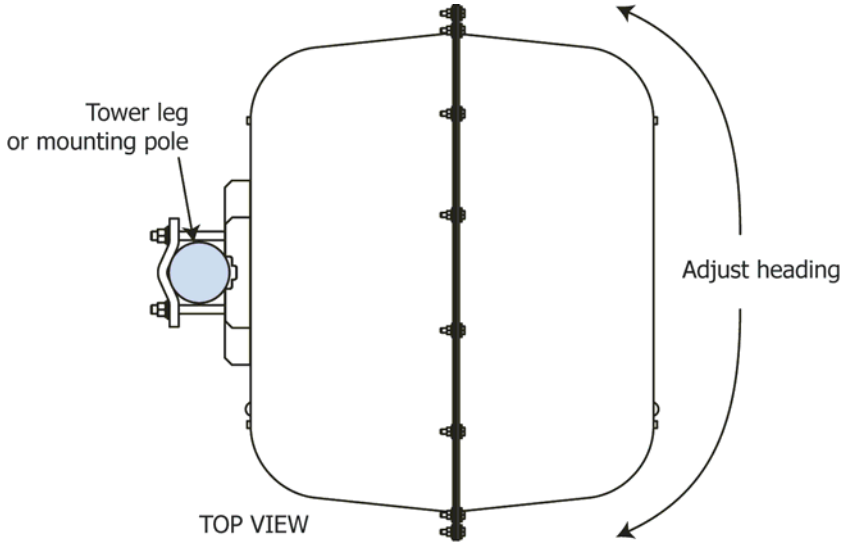
c. (With radomes only) Similarly, clamp the upper and lower end mount channels (19) to the tower leg or pole (Figure 36). Do not tighten fully.

Figure 36. Mount the antenna bay(s) (with radomes)



d. (Figure 37) Adjust the antenna heading.

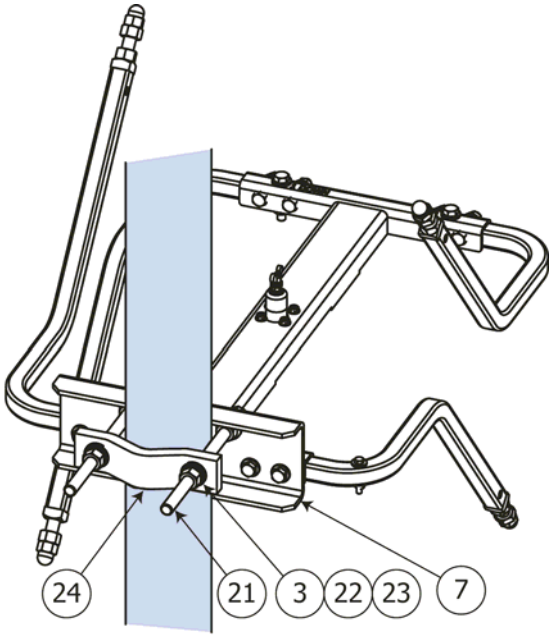
Figure 37. Adjust the heading.



Bay with radome shown. Bay without radome is similar.

e. (Figure 38) Tighten the mounting hardware (Figure , 3, 21, 22) on the threaded rods (2). Torque in accordance with Table 1 on page 1.

Figure 38. Tighten mounting hardware.



Bay without radome shown. Radome bay is similar.

f. Retouch the tower paint as necessary.

g. (2-bay or 4-bay) Repeat this chapter for the remaining bays.

6 Connecting the Antenna (single-bay)

Connect the coax feedline cable.

CAUTION

Stressing a coax connection after assembly can detune the system. Therefore, never make a connection and then bend or twist the cable, or use the connector to force the coax into shape. Form the cable first, then attach it to the connector.

CAUTION

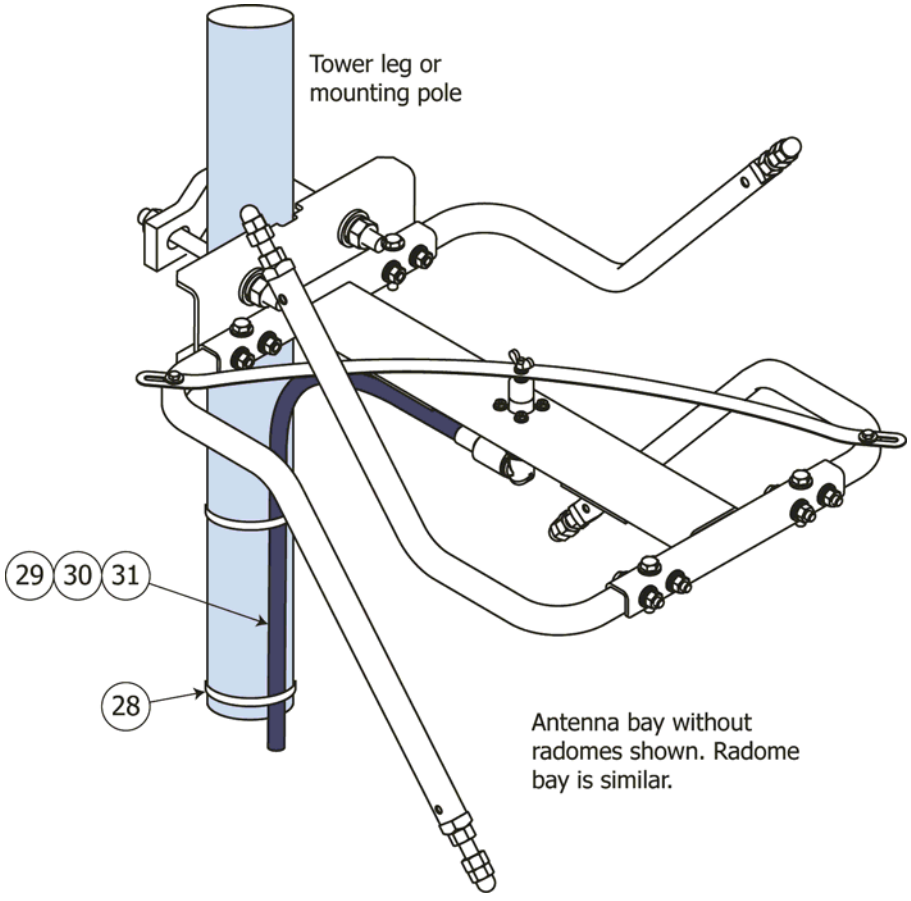
The minimum bending radius for 1/2" coax is 3" (8 cm). Do not bend it too tightly; you may damage it.

CAUTION

Do not overtighten the connectors. Overtightening may damage them.

a. Secure the cable to the mounting pole or tower leg, using tie-wraps (Figure 39, 29) or customer-supplied cable clamps.

Figure 39. Secure feedline cable



Connect the transmission line cable.

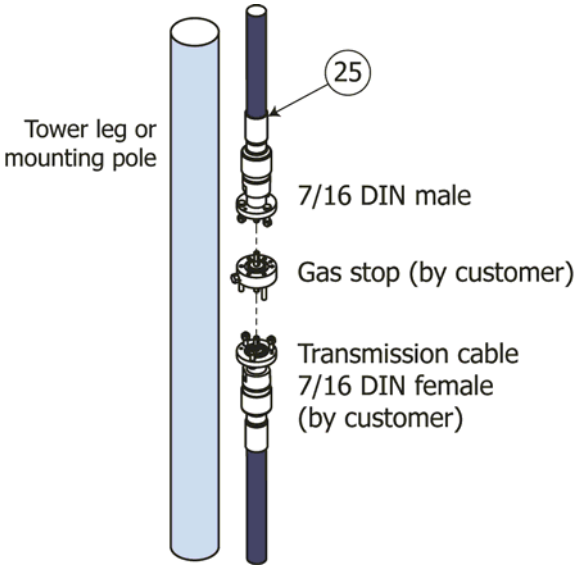
You need to provide a transmission line cable from your transmitter, terminated with a female 7/16 DIN connector.

CAUTION

The antenna is non-pressurized. If you are using pressurized cable, you must install a gas stop at the coax cable input.

a. (Figure 40) Connect the transmission line cable to the coax cable input, with a gas stop if necessary. Torque to 18 - 22 lb-ft (2.4 - 3 Pa). Seal with splice tape.

Figure 40. Transmission line connection



b. Secure the transmission line cable to the mounting pole or tower leg, using customer-supplied cable clamps.

Installation of your Versa2une is complete. Please proceed to Startup.

NOTE

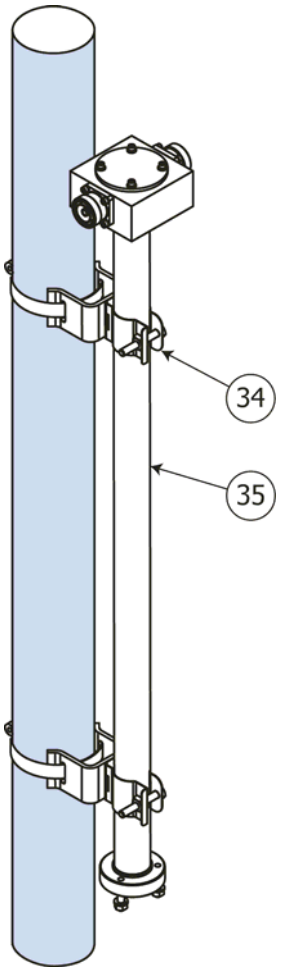
If you have any problems with installation, call Shively and talk with a designer or Sales.

7 Connecting the Antenna (Two-Bay)

Mount the power divider.

Figure 41. Power divider mounting

a. Using two power divider mounting kits (Figure 41, 30), mount the power divider (31) to the mounting structure with its outlet ports roughly halfway between the antenna elements.



Secure the feedline cables.

CAUTION

Stressing a coax connection after assembly can detune the system. Therefore, never make a connection and then bend or twist the cable, or use the connector to force the coax into shape. Form the cable first, then attach it to the connector.

CAUTION

The minimum bending radius for 1/2" coax is 3" (8 cm). Do not bend it too tightly; you may damage it.

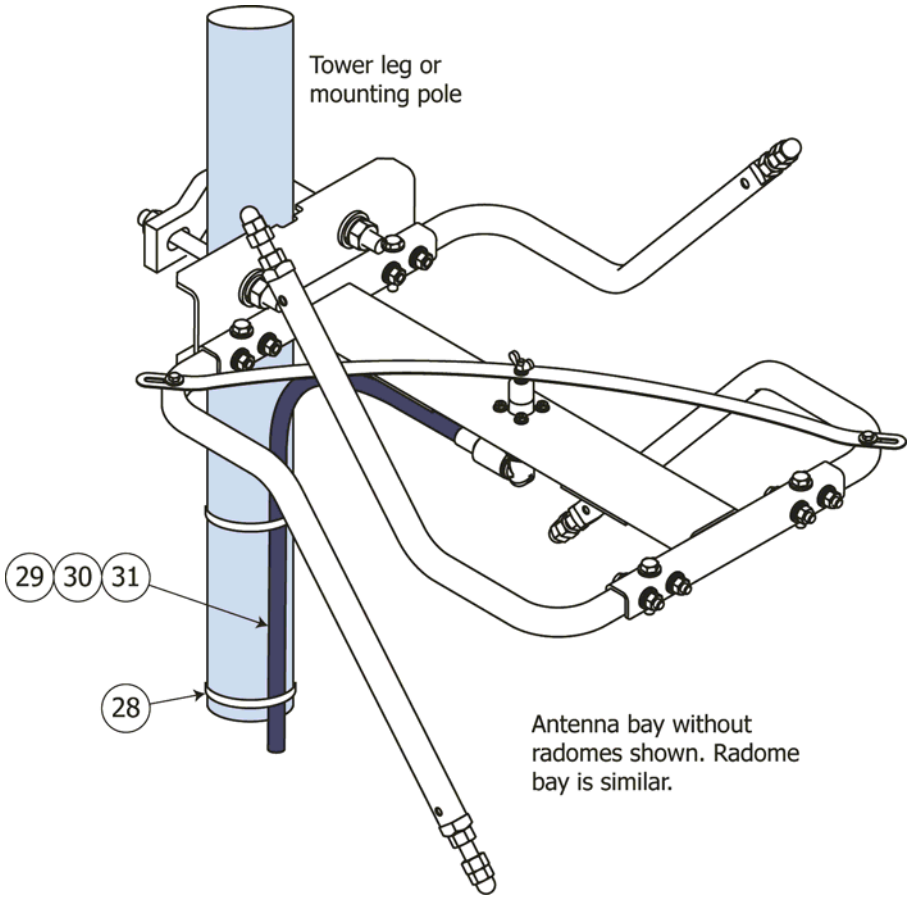
CAUTION

Do not overtighten the connectors. Overtightening may damage them.

a. Connect the input end of the cable to one of the power divider outputs. Torque to 18 - 22 lb-in (21 - 25 cm-kg). Seal with splice tape.

b. Secure the cable to the mounting pole or tower leg, using the tie-wraps (Figure 42, 29) or customer-supplied cable clamps.

Figure 42. Secure the feedline cables



c. Repeat for the other bay.

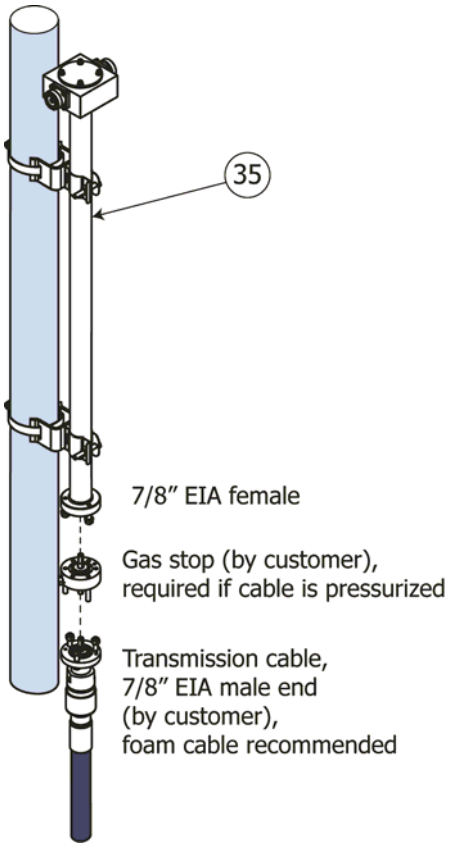
Connect the transmission line cable.

CAUTION

The antenna and power divider are non-pressurized. If you are using pressurized transmission line cable, you must install a gas stop at the power divider input.

a. (Figure 43) Connect the transmission line cable from the transmitter to the power divider input, with a gas stop if necessary.

Figure 43. Transmission line cable connection



b. Secure the transmission line cable to the mounting pole or tower leg, using customer-supplied cable clamps.

Installation of your Versa2une is complete. Please proceed to Startup.

NOTE

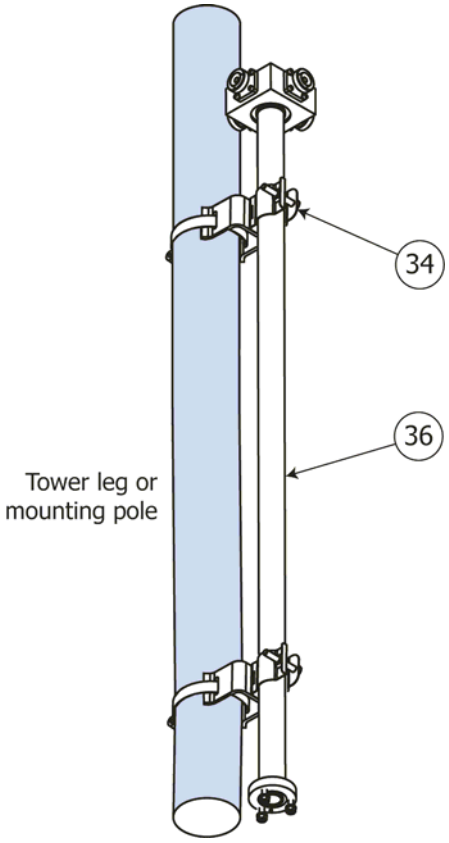
If you have any problems with installation, call Shively and talk with a designer or Sales.

8 Connecting the Antenna (Four-Bay)

Mount the power divider.

Figure 44. Power divider mounting

a. Using two power divider mounting kits (Figure 44, 30), mount the power divider (32) to the mounting structure with its outlet ports roughly halfway between antenna bays 2 and 3.



Secure the feedline cables.

CAUTION

Stressing a coax connection after assembly can detune the system. Therefore, never make a connection and then bend or twist the cable, or use the connector to force the coax into shape. Form the cable first, then attach it to the connector.

CAUTION

The minimum bending radius for 1/2" coax is 3" (8 cm). Do not bend it too tightly; you may damage it.

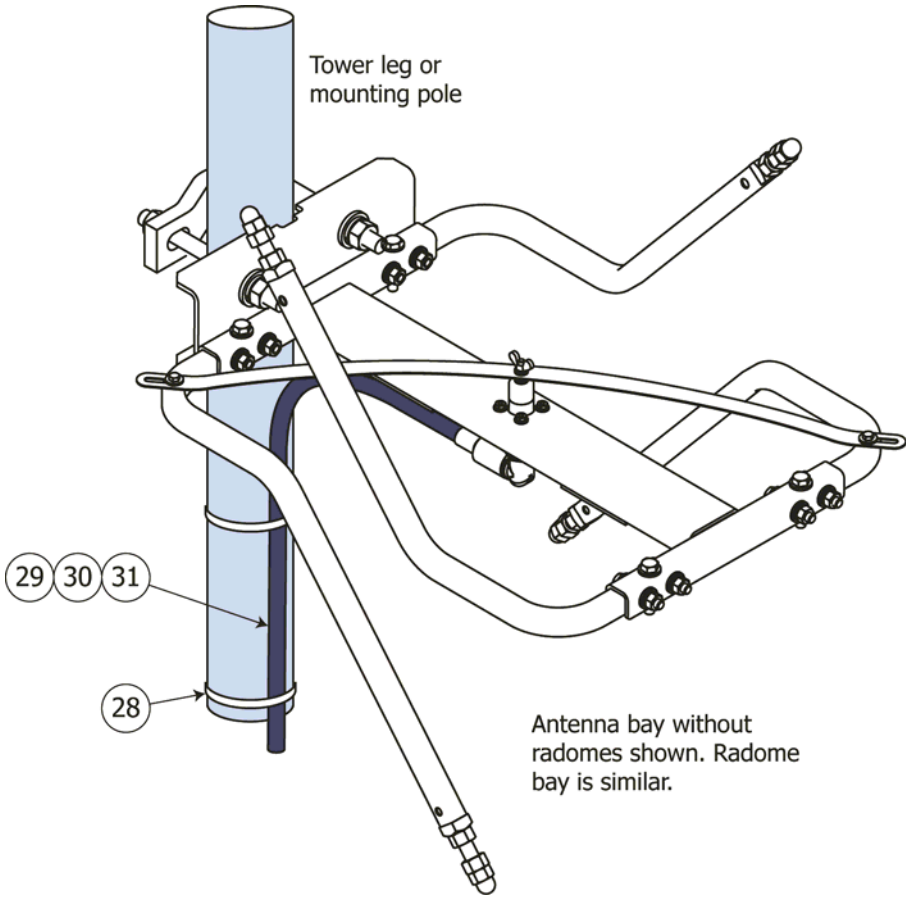
CAUTION

Do not overtighten the connectors. Overtightening may damage them.

a. Connect the input end of the cable to one of the power divider outputs. Torque to 18 - 22 lb-in (21 - 25 cm-kg). Seal with splice tape.

b. Secure the cable to the mounting pole or tower leg, using the tie-wraps (Figure 45, 29) or customer-supplied cable clamps.

Figure 45. Secure the feedline cables



c. Repeat for the other bays.

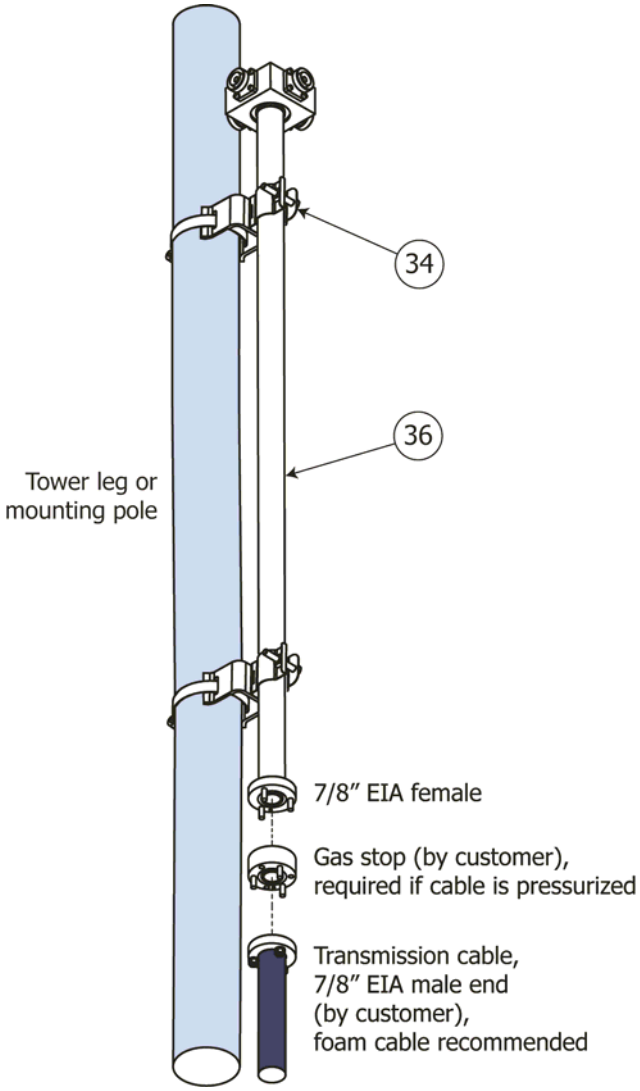
Connect the transmission line cable.

CAUTION

The antenna is non-pressurized. If you are using pressurized transmission line cable, you must install a gas stop at the power divider input.

a. (Figure 46) Connect the transmission line cable from the transmitter to the power divider input, with a gas stop if necessary.

Figure 46. Transmission line connection



b. Secure the transmission line cable to the mounting pole or tower leg, using customer-supplied cable clamps.

Installation of your Versa2une is complete. Please proceed to Startup.

NOTE

If you have any problems with installation, call Shively and talk with a designer or Sales.

9 Startup

WARNING

Whenever a rigger is on the tower in the area of the antenna, shut off the signal and lock it off so that it cannot be turned on accidentally. RF emissions at close range are hazardous.

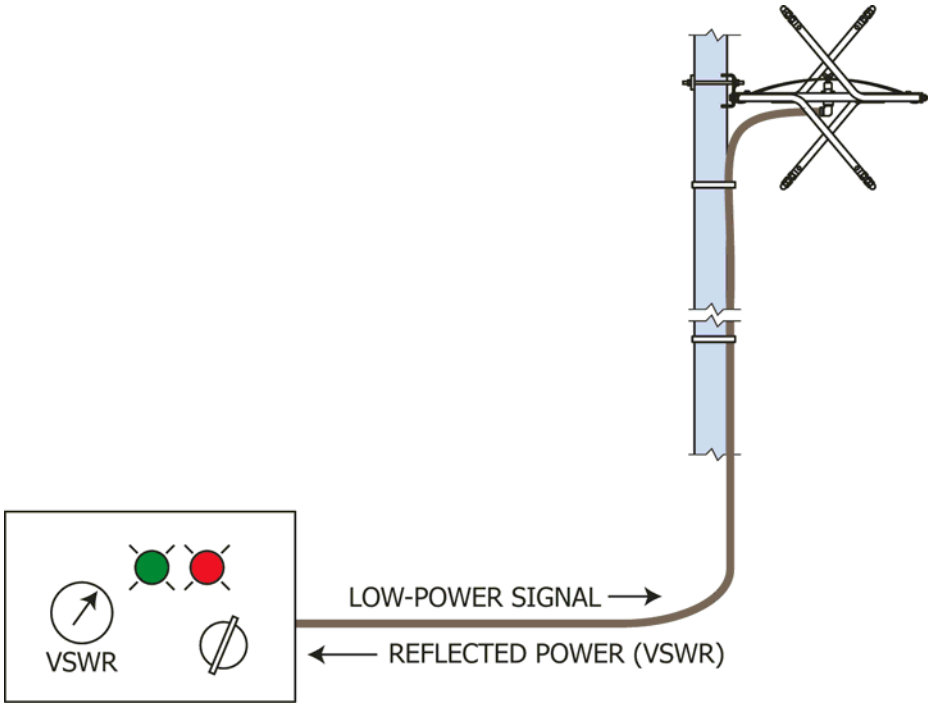
NOTE

The Versa2une does not require pressurization or purging.

Optimize VSWR.

(Figure 47) Apply a low-power signal to the antenna and read reflected power (VSWR). VSWR should be below 1.2:1.

Figure 47. Apply the signal



Adjust to minimize reflected power if necessary.

a. Loosen one jam nut on one arm of one antenna element and lengthen that arm by 10 mm (3/8"). With personnel clear, check VSWR again.

b. If the VSWR (reflected power) has increased, return that arm to its original setting. Then shorten ALL arms by 3 mm (1/8").

c. If the VSWR has decreased, return that arm to its original setting. Then lengthen ALL arms by 3 mm (1/8").

d. Repeat steps a - c until VSWR is below 1.2:1.

e. Secure all the arms by tightening their jam nuts.

Operate.

Once the antenna has been installed and VSWR has been confirmed, simply apply the transmitter signal. Don’t exceed the rated power of the antenna.

10 Troubleshooting

Broad Spectrum RF Noise

This indicates that some component is not in good electrical contact with the tower. Make sure mounts are tight, that tower paint has been removed from under the mounts, and that components of other systems are likewise in good contact with the tower.

High VSWR

This is caused by any factor that changes the impedance match between the antenna and the transmitter. Look for:

- Defective RF connector. Make sure connectors are in good shape, and that center pins are not bent over.
- Damage to any antenna components.
- Paint on radiators.
- Ice buildup on radiators.
- Interference from other tower components, especially components broken by wind or ice.

Change in Coverage

This may be caused by the same factors that can cause high VSWR. Look for VSWR changes as well.

Do recognize, however, that apparent changes in coverage may be due to subjective factors or faults of the receiving equipment. Before doing more than checking the VSWR, be sure that an actual coverage change has occurred.

11 Maintenance

WARNING

Whenever a rigger is on the tower in the area of the antenna, shut off the signal and lock it off so that it cannot be turned on accidentally. RF emissions at close range are hazardous.

Log

We recommend that you keep a log of VSWR readings and any other performance notes and maintenance history for your antenna. Such a record can be invaluable for troubleshooting.

Inspection

Whenever a rigger is on the tower for any reason, it is a good idea to have him check your antenna for general condition, looseness of connectors and mounts, and electrical damage.

Paint

The radiator should never be painted; this will affect the VSWR.

Return Policy

When returning any material to the factory, be sure to call your salesperson and obtain an returned materials authorization (RMA) number first. Material may be refused and sent back to you at your expense if you don't do this.

12 Parts

Parts list.

NOTE

Item callouts are consistent across all the illustrations in this technical sheet.

Table 2. Parts List

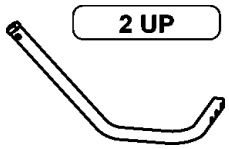
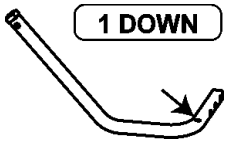
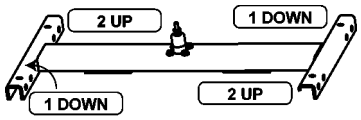
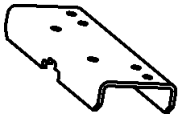
Description	without radomes			with radomes			Shively P/N	Appearance (not to scale)
	1 bay	2 bays	4 bays	1 bay	2 bays	4 bays		
1. "Acorn" nut, M12 x 1.75	4	8	16	4	8	16		
2. Threaded rod, M12 x 1.75 x 230 mm (9 in) long	6	12	24	10	20	32		
3. Hex nut, M12 x 1.75	26	52	104	8	16	32		
4. Arm without feed-strap hole (marked with 2 UP sticker)	2	4	8	2	4	8	99350-G505	
5. Arm with feedstrap hole (marked with 1 DOWN sticker)	2	4	8	2	4	8	99350-G506	
6. Radiator subassembly with end seal (number stickers indicate arm locations)	1	2	4	1	2	4	99350-G502	
7. Center channel mount	1	2	4	1	2	4	99351-01	
8. Hex bolt, M8 x 1.25 x 45	12	24	48	28	56	112		
9. Hex nut, M8 x 1.25	10	20	40	10	20	40		
10. Flat washer, M8	26	52	104	18	36	72		
11. Lock washer, M8	10	20	40	10	20	40		

Table 2. Parts List (continued)

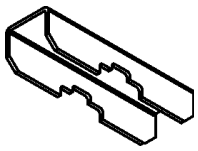
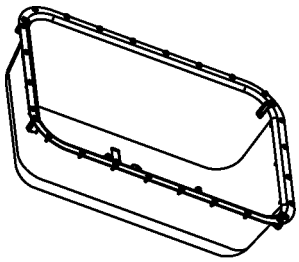
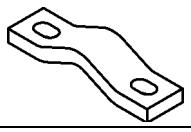
Description	without radomes			with radomes			Shively P/N	Appearance (not to scale)
	1 bay	2 bays	4 bays	1 bay	2 bays	4 bays		
12. Wing nut (shipped on endseal, item 13)	1	2	4	1	2	4		
13. Endseal (part of radiator)	ref	ref	ref	ref	ref	ref		
14. Feedstrap	1	2	4	1	2	4	99350-04	
15. Hex bolt, M5 x 0.8 x 35	2	4	8	2	4	8		
16. Hex nut, M5 x 0.8	2	4	8	2	4	8		
17. Flat washer, M5	4	8	16	4	8	16		
18. Lock washer, M5	2	4	8	2	4	8		
19. End channel mount	n/a	n/a	n/a	2	4	8	99351-02	
20. Back radome half (cable hole & slot for radiator channel)	n/a	n/a	n/a	1	2	4	99348-01	
21. Flat washer, M12				18	36	72		
22. Lock washer, M12				12	24	48		
23. Clamp half	n/a	n/a	n/a	3	6	12	SCP	
24. Coax cable section, 10 ft (~3 m) long with elbow connector on output end and 7/16 DIN male connector on input end	1	2	4	1	2	4	99349-G510	

Table 2. Parts List (continued)

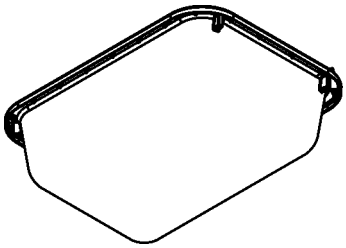
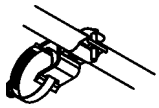
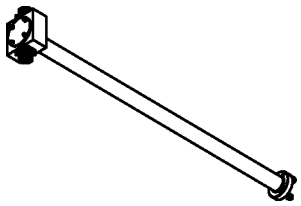
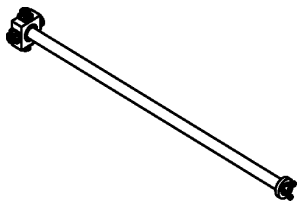
Description	without radomes			with radomes			Shively P/N	Appearance (not to scale)
	1 bay	2 bays	4 bays	1 bay	2 bays	4 bays		
25. Dow Corning 744 adhesive-sealant, cartridge	n/a	n/a	n/a	1	1	1	DO 88060	
26. Splice tape	1	2	4	1	2	4	92042-01	
27. Radome flange bolt kit (contains 24 bolts, 24 nuts, 48 flat washers, 24 lock washers)				1	2	4	93585-G504	
28. Front radome half (overlapping flange)	n/a	n/a	n/a	1	2	4	99348-02	
29. Tie-wrap	36	72	144	36	72	144	TY529MX	
30. Power divider mounting kit	0	2	2	0	2	2		
31. Power divider, 2-way (with mounting clamps)	0	1	0	0	1	0	99332-G502	
32. Power divider, 4-way (with mounting clamps)	0	0	1	0	0	1	99385-G501	
33. Hex nut, 6-32 SS	4	8	16	4	8	16		
34. Flat washer, #6 SS	4	8	16	4	8	16		

Table 2. Parts List (continued)

Description	without radomes			with radomes			Shively P/N	Appearance (not to scale)
	1 bay	2 bays	4 bays	1 bay	2 bays	4 bays		
35. Lock washer, #6 SS	4	8	16	4	8	16