1. SRU Antenna Alignment

1.1 Introduction

This chapter gives instructions for aligning the SRU antennas to the BRU for maximum signal strength.

Before alignment of the antenna, perform the following steps:

1. Refer to “SAS Installation Manual” and perform the indicated procedures. Most of the principles used to locate a site for the Base Radio Unit can be applied to SRU placement.
2. Install the Base Station as explained in “BSIS Installation Manual.”
3. Install one or more Subscriber terminals as explained in “SAS Installation Manual.”
4. Install the Link Explorer PMP and configure the Base Station as explained in “BSIS Installation Manual.”

The direction in which the SRU antenna points must be aligned to the location of the associated BRU to ensure that maximum received signal strength is achieved at both ends of the microwave link. Although the antenna radiation pattern is typically thought of as a “beam,” the radiation pattern actually consists of “lobes,” as shown in Figure 1-1. How you planned your network will help identify which specific antenna is used in this ST and the BRU for the link.

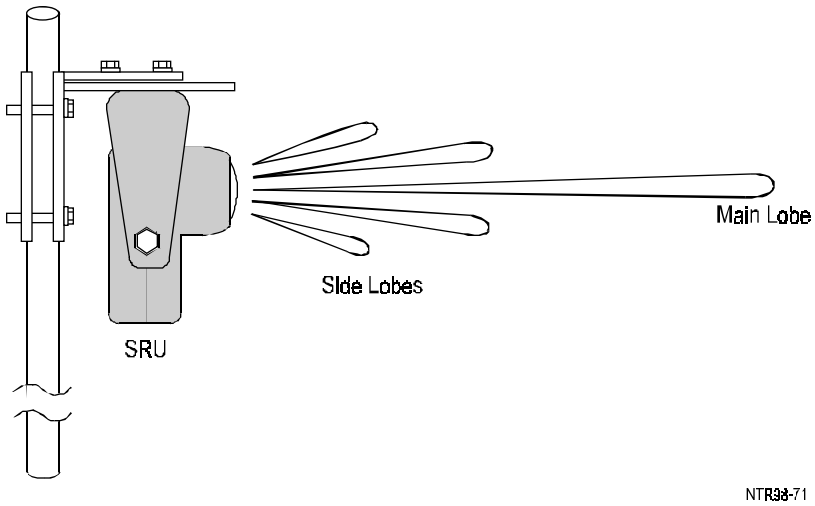


Figure 1-1Antenna Pattern

1.2 SRU Alignment

This chapter contains information about SRU alignment.

1.2.1 Preparation and Overview of Procedure

It is recommended that a person be present at both the SRU and the associated BRU for this antenna alignment procedure. It is also advisable to have some form of communication between the two sites, such as cell phones, two-way radios or telephones. Mirrors or strobe lights (for flashing the path) are recommended for situations in which the antenna locations are not readily visible from one another, as a result of distance or atmospheric conditions. *It is absolutely essential that there are no obstructions present in the path of the beam.*

The objective of this procedure is to aim the main lobe of the SRU antenna precisely in the direction of the associated BRU. This is accomplished by performing a rough visual alignment first; then further alignment is performed while monitoring the Receive Signal Level at the Subscriber Radio Unit with a voltmeter. The alignment process consists of adjusting the direction of the SRU until the received signal level is maximized.

Do not confuse the alignment directions (horizontal, vertical - that is, azimuth, elevation) with the polarization of the antenna feed assembly. Antenna polarization should be established prior to installation. Verify that the polarization of the SRU matches the polarization of the BRU.

Connect a Voltmeter to ensure that the SRU is getting power. A reading of zero means that there is a problem with the SRU, SAS, or cable (or voltmeter). A reading of +4.0 Volts indicates it is likely that the SAS is not admitting and is presently scanning through the channels of the channel plan as it attempts to admit. Or that the SAS cannot admit because

the SRU is drastically out of alignment. Re-align the SRU visually and wait for it to re-admit. If the reading is between 0 Volts and 4 Volts, then the SAS has admitted.

Tighten the lock nut/washers to eliminate most freeplay, but not so tight that you can't move the SRU in both directions.

During the rough alignment procedure (see below) the purpose is to align the SRU visually, both elevation and azimuth. If it is totally off-lobes it will read very high (and you'll be able to see that it is not aligned). Attach the voltmeter. Adjust it visually in both dimensions to determine where the main lobe is centered.

Adjust the azimuth for the maximum reading. Tighten the azimuth bolts bit by bit without losing the reading. Repeat for elevation. Remove the voltmeter and replace the hanging cap.

The purpose of the fine alignment procedure (see below) is to achieve precise antenna alignment, which is critical for optimum system performance. Make sure the antenna is aligned on the main lobe as shown in Figure 1-2, this arrangement produces a significantly lower receive signal strength, making your system more vulnerable to outage due to fading. Parabolic antennas are highly directional (focused) and any movement of the antenna during alignment should be performed SLOWLY. This allows observation of the side and main lobes during antenna movement. It is important to verify that the SRU antenna is aligned to the MAIN LOBE.

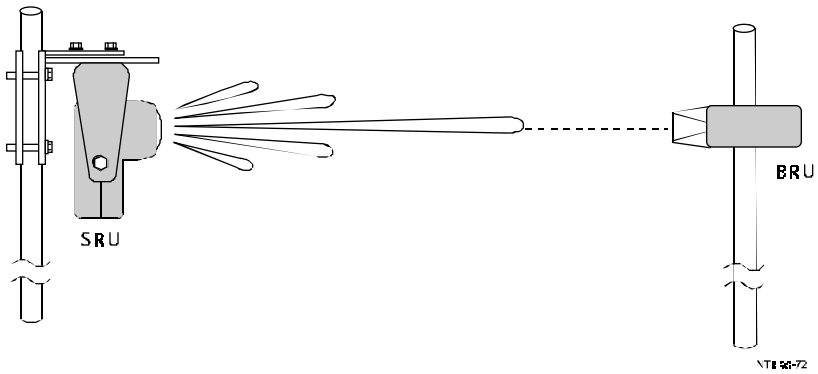


Figure 1-2 Correct Antenna Alignment

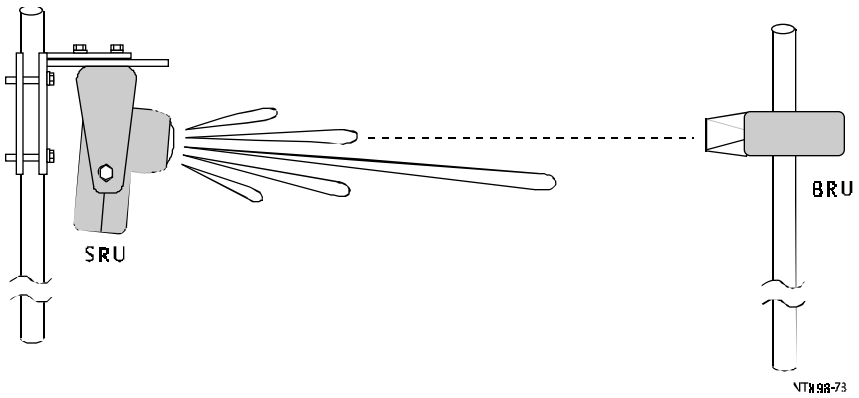


Figure 1-3 Incorrect Antenna Alignment on a Sidelobe

Typically, if your final receive signal level (RSL) is approximately 30 dB below the calculated value, the link is either aligned on a side lobe or the antenna polarizations are mismatched.

1.2.2 Alignment of SRU

Before proceeding, verify that the antenna and mount have been properly assembled.

Verify that both ends of the link are powered-up.

1.2.2.1 Azimuth Procedure

To perform the rough azimuth alignment, complete the following steps:

1. Set the azimuth adjusting plate at roughly the middle of its range (centered) and lock it down. Have the person at the far end use a mirror or strobe light to make the opposite site more visible. If necessary, loosen (slightly) the pole mount brackets and rotate the antenna assembly on the mounting pole. If needed, the Voltmeter can be used now.

2. With the antenna pointed toward the BRU, slowly tighten the azimuth adjustment lock nut/washers. While tightening them, check to see that the antenna remains pointing directly at the other site.

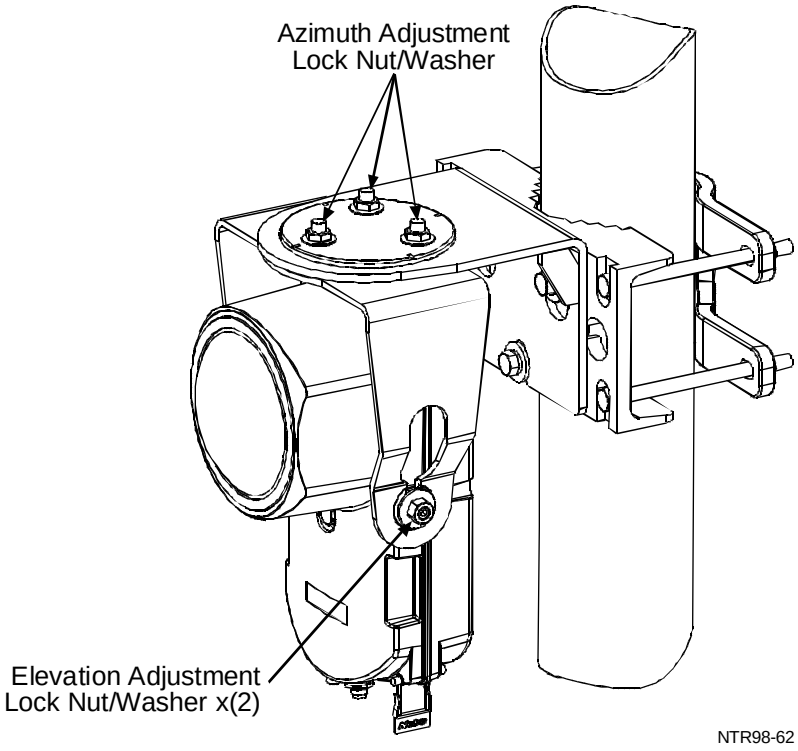


Figure 1-4 26 GHz and 39 GHz SRU Elevation and Azimuth Adjustments

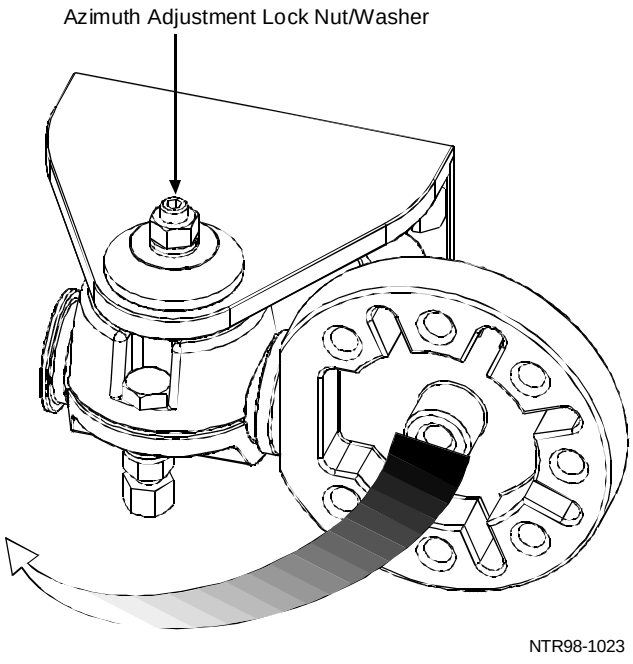


Figure 1-5 10 GHz SRU Azimuth Adjustment Lock Nut/Washer

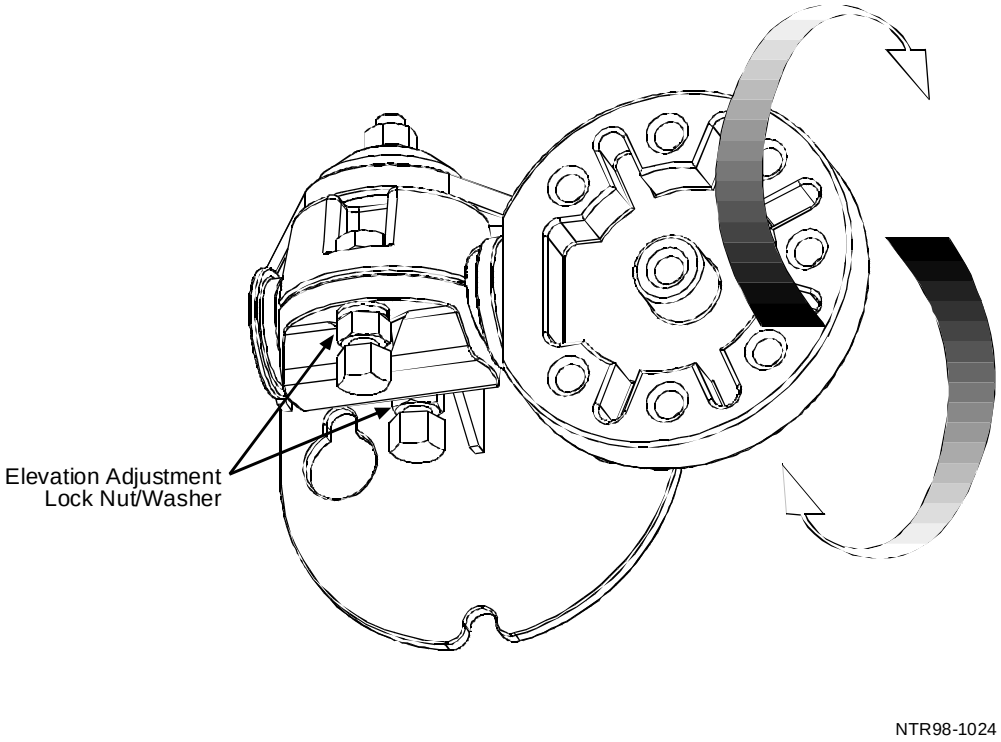


Figure 1-6 10 GHz SRU Elevation Adjustment Lock Nut/Washer

1.2.2.2 Elevation Procedure

Make rough elevation adjustment using the same technique used for adjusting azimuth. Move the antenna up or down until it points directly at the BRU. Use a mirror or strobe light to make the opposite end more visible. Tighten the elevation adjustment nuts when complete.

1.2.3 Rough Alignment During Poor Visibility Conditions

If poor visibility conditions obscure the view of the far end, it is still possible to perform the rough alignment. The azimuth can be adjusted using a compass to aim the antenna in the direction determined by plotting the two locations on a topographical map.

The elevation can be adjusted using a carpenter's spirit level to aim the antenna at the horizon (level). For distances of more than roughly two kilometers, this method is often sufficiently accurate since the far end is essentially on the horizon; for example, rough alignment within two degrees over a three kilometer path will accommodate a height difference of over 100 meters between the two sites.

1.2.4 Final Alignment

After completion of the initial alignment procedure, begin to further align the antenna. This alignment is accomplished by adjusting the elevation and azimuth while observing the Receive Signal Level (RSL).

This adjustment procedure involves panning the antennas in order to zero-in on the maximum receive signal, as indicated on a voltmeter, thereby properly aligning the main lobe of the microwave radiation pattern.

NOTE

Several alarms remain active until the installation has been completed. When the radio link becomes functional, the red SRU Alarm LED extinguishes on the SAS front panel.

1.2.4.1 Panning SRU Antenna

To maximize the RSL, connect the voltmeter to the RSL BNC connector on the SRU and pan the antenna by moving the adjustments through the voltage peaks on the voltmeter. Continue adjusting it in the same direction until the voltage decreases and then increases it again. Use this method to identify the minor side lobes, which have lower peaks than the major lobe. After identifying the side lobes, adjust back to the maximum voltage again. This procedure must be performed on both the elevation and the azimuth directions. This method of panning the antenna ensures accurate alignment on the center of the main lobe.

1.2.5 RSL Calculation and Verification

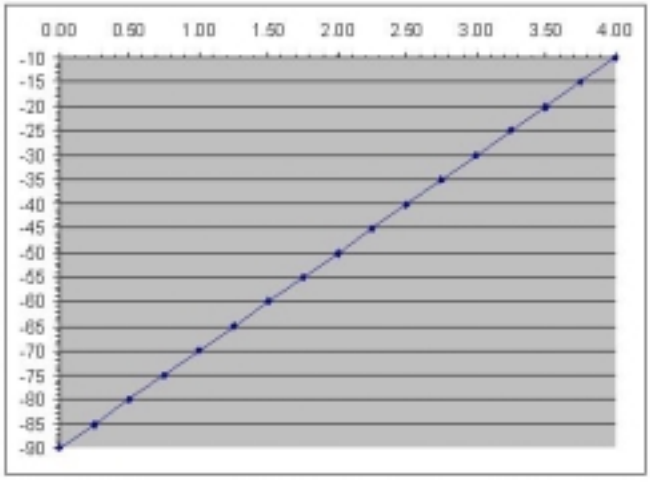
The measured RSL of properly aligned antennas with an unobstructed path should be ±3 dB of the calculated RSL for an ST at the center of the main beam. For an ST at a 3 dB point of the main beam, the power will be 3 dB less. How you planned your network will determine the beam width and 3 dB points of the BRU main beam and the direction of the SRU relative to the BRU main beam center and 3 dB points

A professional microwave propagation path engineering program is recommended for calculating the RSL. The Path Explorer program from Netro Corporation can perform initial path calculations. The Path Explorer program can calculate the expected RSL in either dBm, or the voltage related to the calibrated voltage at the BNC connector

SRU Voltage Calibration

RSL (v) = [RSL (in dBm) - (-90 dBm)] X 0.050v/dB

RSL	Voltage
-10	4.00
-15	3.75
-20	3.50
-25	3.25
-30	3.00
-35	2.75
-40	2.50
-45	2.25
-50	2.00
-55	1.75
-60	1.50
-65	1.25
-70	1.00
-75	0.75
-80	0.50
-85	0.25
-90	0.00



RSL Voltage Calculation Example

You have aligned the SRU and you read a voltage of 1.125 V, What is the RSL?

Use the following formula:

$$\frac{\text{Measured Voltage}}{0.050} - 90 = \textbf{RSL (in dBm)}$$

(The Answer is -67.5 dBm)