SIMULSAT OPERATION

AND

MAINTENANCE MANUAL

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1.0 INTRODUCTION

This manual provides instructions for the operation and maintenance of the Simulsat multi-beam satellite antenna.

1.1 BASIC DESCRIPTION

Simulsat is a **Sim**ultaneous **Mul**tiple **Sat**ellite antenna. It was developed by ATCi to address present and future demands on Cable TV operators and television stations to have TVRO systems view more than one satellite simultaneously without creating an antenna farm. The Simulsat uses a quasi-parabolic reflector to view 70° of satellite arc.

Simulsat, through its unique design, captures signals across 70° of satellite arc. Each satellite within the 70° of satellite arc is capable of being received. Each satellite illuminates a discrete area of the Simulsat reflector surface. The signals reflect to their corresponding C-band, Ku-band, or dual-band feed and then are relayed to the satellite receivers. The Simulsat design, with its multiple points of reflection, recreates the capabilities of many C/Ku parabolic dishes with uniform signal reception and high signal quality across the entire 70° of satellite arc.

1.2 MATERIALS

Most of the Simulsat's hardware consists of A325 high strength, (or Grade 5) bolts. Any substitutions to the hardware parts kit must be equal in strength and function. The feedbox and reflector assemblies are constructed from fiberglass. The ring and mount are constructed from galvanized steel. The support braces, reflector splice straps, and feed box legs are constructed from aluminum.

1.3 ACCESSORIES

At ATCi, we use the ATCi TE900 portable spectrum analyzer. It has the features and performance that make it the ideal spectrum analyzer for Simulsat satellite feed peaking. The TE900 is a compact spectrum analyzer, satellite receiver, and monitor in one. The TE900 provides power to the LNB, has an internal battery, and has an acoustic level indication to facilitate feed peaking. The TE900's combination of features in a compact, easy-to-handle package make it the right tool for satellite feed peaking and an economical choice in satellite equipment. For more information on the TE900 spectrum analyzer contact ATCi at 480-844-8501.

All of the feed-peaking adjustments can be made without a spectrum analyzer using only a satellite receiver and video monitor and peaking to minimize noise in the video, or even connecting a volt meter to the AGC of a satellite receiver for a signal strength indication, but usually it is best to use a spectrum analyzer to optimize feed signal strength. Additionally, you will likely need: an extension cord, various RF connectors and adapters, and some jumper cables to make the necessary connections. If you are using a spectrum analyzer that does not provide power to the LNB, you will need either a power inserter, or a splitter so that you can utilize your receiver's power while allowing signal to pass to the spectrum analyzer. You will also likely need a listing of satellite programming. There are satellite-TV publications that provide this kind of information. There are also web-based listings at http://www.lyngsat.com/ and http://www.satcodx.com/.

1.4 ANTENNA SURVIVABILITY

The Simulsat is designed to meet the structural requirements of the Uniform Building Code Chapter 27 and Section 2303 to withstand 125 mph winds. It is important that no substitutions or alterations to any of the parts be made without the approval of ATCi.

2.0 ALIGNMENT

For optimum performance, the Simulsat antenna must be properly aligned. A properly aligned Simulsat antenna with a 70° feedbox will allow feeds for satellites in the entire U.S. domestic view-arc to peak within the confines of the feed box. The U.S. domestic arc extends from 69° West longitude to 139° West longitude. If while peaking you run the feed assembly into the side or end of the box before seeing the power level of the signals drop off, your antenna needs realignment.

The realignment of the Simulsat antenna involves rolling the reflector assembly to the proper roll angle, raising or lowering the reflector assembly to the proper elevation angle, and pivoting the mount to the proper azimuth angle. For new installations, elevation, azimuth, and roll are calculated, but the calculated values are only used to roughly align the reflector to the satellite arc. The final alignment of the reflector is arrived at by carefully adjusting the alignment so that the feeds for the desired 70° satellite view arc peak within the confines of the feed box.

2.1 ROLL ANGLE PROCEDURE

When standing behind the reflector looking toward the satellite arc, positive roll values are counter-clockwise, and negative roll values are clockwise. The roll angle is adjusted from the horizontal position by rotating the reflector assembly on the mount ring. The reflector assembly will have little or no roll when it is first installed onto the mount. Roll can be gauged by using an inclinometer to check the angle of the horizontal members of the reflector side braces (trusses). (Note: Using an inclinometer, the roll angle indication will not be accurate and will be less accurate for greater roll angles due to geometric incongruencies between the reflector's axis and the side brace location.) Roll can also be gauged by measuring the arc length of the difference between points that were coincident on the mount ring and the reflector's hat ring. That is, as the reflector is rolled, the distance between points that were coincident on the mount ring and the hat ring when the reflector was horizontal (measured along curvature of either feature) is an indication of roll. For the

Simulsat-5, 1.1” = 1°. The following are roll alignment procedures with and without using a crane:

2.1.1 ADJUSTING ROLL USING A CRANE

Step 1
Make sure that all of the ring clamp plates are loose. For large amounts of roll, some clamp plates may have to be completely removed in order to clear the clevises on the mount ring. Always have at least 4 clamp plates (with rollers – pipe) holding the reflector onto the mount ring.

Step 2
Rig one end of a crane strap to the outermost and bottom panel demold lug on the side of the reflector that needs to be rolled upwards. The demold lugs are the metal bar loops on the back side of the reflector panels.

Step 3
Position the crane so that it will pull in-line with the plane of rotation of the reflector on the mount ring. That is, the crane boom will be behind the reflector and positioned so that when tension is put on the line, the line will rotate the reflector without putting undue stress on the reflector.

Step 4
Rotate the reflector assembly to the desired roll angle. Inspect the roll angle either with an inclinometer or by measuring the arc length (see 2.1).

2.1.2 ADJUSTING ROLL USING A COME-ALONG

Step 1
Make sure that all of the ring clamps plates are loose. For large amounts of roll, some clamp plates may have to be completely removed in order to clear the clevises on the mount ring. Always have at least 4 clamp plates (with rollers – pipe) holding the reflector onto the mount ring.

Step 2
Attach a come-along between a loosened reflector clamp plate bolt and a convenient place on the mount (typically near the upper ring clevis mount point), so that when tension is applied with the come-along, the reflector will rotate in the desired direction.

Step 3
Rotate the reflector assembly to the desired roll angle. Inspect the roll angle either with an inclinometer or by measuring the arc length (see 2.1).

2.2 ELEVATION ANGLE PROCEDURE

The elevation angle is adjusted with the elevation column jack. (Note: 0° elevation corresponds to the reflector assembly looking at the horizon, and 90° elevation corresponds to the reflector assembly looking straight up (zenith)).

Step 1
Raise or lower the reflector assembly to the appropriate elevation angle by adjusting the elevation column jack.

Step 2
Inspect the elevation angle by placing an inclinometer against the back of the mount ring.

Note: If the elevation jack's range of motion is too small to correctly align the reflector, a crane will likely be required so that the length of the elevation columns can be adjusted. Call ATCi for information on this procedure.

2.3 AZIMUTH ANGLE PROCEDURE

The azimuth angle is adjusted by pivoting the entire antenna around the pivot bolt of the azimuth pivot stand, which is at the rear of the mount. If the foundation has been laid out correctly, the foundation centerline should be set at the correct azimuth angle, and the azimuth starting point for electrical alignment will be where the mount is aligned with the foundation centerline. (Note: It is very important to correctly apply magnetic deviation when using a compass to establish the foundation centerline.) However, even if the foundation centerline is correct, some adjustment in azimuth may be necessary. (A value of zero azimuth corresponds to true north. Azimuth values increase clockwise). The Simulsat mount affords ±10° of azimuth adjustment.

Step 1.0
Attach the come-along to the end of the azimuth track (on the side that the mount has to rotate towards) and the bottom of the front foot assembly.

Step 2.0
Pull the mount to the appropriate azimuth with the come-along.

3.0 FEED PEAKING

Simulsat feed assemblies allow adjustment in azimuth, elevation, focal length, and polarity. An important part of peaking Simulsat feeds is to set up the equipment used for peaking in or on top of the feed box. This way you get immediate feedback and can zero in on the peak more quickly and accurately. Prior to moving feed assemblies up to the feedbox, fasten the LNB's to the feed assemblies and tighten the elevation, focal length, and polarity adjustments of the feed assemblies. A bare LNB can be used with the spectrum analyzer to help locate the general location of signals in the feedbox. If you do not have a spare LNB, you may want to postpone fastening one LNB to its feed assembly until you no longer need a bare LNB in the feedbox. If possible, peak feeds in the early morning or early evening. Sunlight can make it difficult to see the analyzer display and the video monitor.

3.1 FEED PEAKING TOOLS AND EQUIPMENT

- 5/32" and 3/16" hex keys. We recommend ball-end hex drivers because of their ability to access socket head screws at odd angles. For peaking 2° spaced feeds, long-handle ball drivers make the job easier.
- 5/16" and 7/16" wrenches.
- Felt tip marker.
- Feedbox spacer bars. Spacer bars are available from ATCi.
- Ladder or a bucket truck.
- Satellite receiver.
- Video monitor.
- Low noise block down-converters (LNB).
- Spectrum analyzer.

Note: If an ATCi TE900 spectrum analyzer is used, a satellite receiver and video monitor are not required because it has satellite receiver and video monitor functions.

3.2 LOCATING SIGNALS

Frequently, the first thing to be done after setting up is to locate the desired satellite in the feedbox. Your view of the satellites looking into the feedbox is the same as your view of the satellites in the sky looking at the satellite arc. General feed locations can be found by connecting a bare LNB to a spectrum analyzer and scanning in the feedbox. When looking for feed locations this way, be careful to keep the LNB polarized correctly. The LNB should be held so that either the long or short sides of the rectangular entry port of the LNB are parallel with the sides of the feedbox. Occasionally a satellite will have carriers on only one polarity. In this case, you may need to try scanning the feedbox for each polarity. Certain satellites have distinct signatures and can be easily located.

Once a satellite is located, you can gauge where satellites are in its vicinity. In the Simulsat-5 feedbox, 1° of satellite longitude is equal to approximately 2" of azimuth travel in the feedbox. For a Simulsat-7 antenna, 1° of satellite longitude is equal to approximately 3" of azimuth travel in the feedbox.

After finding the desired satellite, use a marker or a moistened finger to make a mark in the feedbox window to facilitate relocating the spot with the feed assembly. You can now do a quick check of this location to make sure you are on the right satellite.

Set the elevation adjustment of the feed assembly to approximately where you expect to get a peak. Secure the focal length adjustment of the feed assembly. A good starting point for focal length is approximately 1" closer than the feed assembly's maximum travel away from the reflector. The polarity will usually be just about at right angles to the feedbox. Loosen the track bar fastening screws. Connect the analyzer to the feed, and briefly peak the feed.

The carrier levels in the analyzer display (and the acoustic level indication of the TE900) will rise as the feed approaches the best location and fall as the feed is moved away from the best location. Locate the feed where the carrier levels are at their highest. (Note: See 3.3. The highest carrier level is not always optimal.) Seat the feed assembly into the feedbox tracks. If you are using a TE900, switch to the receiver mode, or if you are not using a TE900, connect the feed to a receiver and monitor, and verify the satellite by checking the programming being received against the program listings of a satellite TV publication. Once satisfied that you are on the right satellite, you can begin peaking.

3.3 SIMULSAT FEED PEAKING PROCEDURE

When peaking feeds, the highest signal indication on an analyzer is not always the optimal performing location of the feed. The noise present has a profound effect on performance. (Note: The most prominent noise feature is frequently a peak of interference from an adjacent satellite.) As such, the optimal performing location will be the location where the difference between the noise and the carriers is the greatest. Also, adjustments made to each plane of motion of the feed assembly impart slight effects on the other planes of motion. It is recommended to go carefully through the following steps, and then repeat them giving particular attention to optimizing the difference between the carriers and the noise. Peaking the feed while paying attention to a particular transponder may be helpful if that transponder is troublesome.

Step 1

Begin with the feed assembly set up the same as in verifying the location of the feed. That is, set the approximate elevation, secure the focal length and polarity, and loosen the screws that secure the azimuth of the feed assembly. If necessary, adjust the distance between the feedbox tracks using the spacer bars. The feed assembly should move easily on the feedbox track. Connect the feed to the spectrum analyzer.

Step 2

Hold the feed assembly slightly above the feedbox track and move it side to side. The carrier levels in the analyzer display (and the acoustic level indication of the TE900) will rise as the feed approaches the best location and fall as the feed is moved away from the best location. Locate the feed at the best performing location. Make sure that you have not peaked the feed onto a side lobe. Seat the feed onto the track. Mark the track adjacent to the feed assembly track bars on each side of the feedbox. Repeat the process using the track marks as a reference. When the feed is at its best location, secure the feed onto the tracks. If tightening the screws causes the feed to move, use a screwdriver wedged between the track bar and the feedbox side to hold the feed assembly in place during tightening.

Step 3
Peak the elevation by zeroing in on the best spot. Make a reference mark on the feed assembly side bars relative to the feed assembly scalar. Repeat the process using the mark as a reference. When you are satisfied that the feed is at its best location, secure the elevation.

Step 4
After setting the azimuth and elevation, adjust the focal length of the feed by moving the feed assembly in and out. Frequently, the focal length adjustment shows less dramatically on the spectrum analyzer, but can still be very important to optimizing the feed's peak. In some cases, particularly for Ku feeds, the best performance will be found farther away in focal length than the standard feed configuration allows. If this appears to be the case, the feed assembly rack can be modified to allow the feed to be secured farther out. Call ATCi for information.

Step 5
Adjust the polarity by rotating the waveguide portion of the feed assembly. Set the polarity so that adjacent polarities are nulled. In 2-degree adjacent situations, the adjacent satellite peak will frequently not completely null.

3.4 SIMULSAT FEED PEAKING PROBLEMS

There are many things that can make feed peaking difficult: terrestrial interference, sun outage, LNB failure, bad connectors, inclement weather, satellite center of box status, and more. Following are some additional suggestions to address problem feeds:

- Check all connectors and splices, especially those in the feedbox, for signal leakage with a bare LNB connected to a spectrum analyzer. Scanning for leakage of L-band frequencies can be done by connecting a rod antenna (1/2-wave dipole) that can telescope between 3-3/4” and 6” with a line amplifier to a spectrum analyzer. Connectors are also potential sources for signal ingress. Replace or wrap aluminum foil around problem connectors.

- Canting or angling the feed can sometimes help with problem feeds.

- Sometimes what appears to be unnullable cross-polarity is actually adjacent satellite co-polarity. You will need to use a spectrum analyzer to see this. If the adjacent carrier is causing problems, the feed should be peaked viewing both carriers on the spectrum analyzer, trying to maximize the difference between the two carriers instead of just trying to maximize the desired carrier's peak. The greater the difference between the desired carrier and an adjacent carrier, the cleaner the pictures. Using a receiver with a narrower bandwidth or adjustable bandwidth that can be narrowed can also help. Adjacent satellite carriers are 20 MHz away from each other. Sometimes a 36 MHz bandwidth receiver (± 18 MHz) sees too much of the adjacent carrier.

- Different combinations of equipment will perform differently. For a problem transponder, try different combinations of receivers, LNB's, and feed assemblies.

4.0 MAINTENANCE

The materials used in the Simulsat require very little maintenance. Fiberglass, aluminum, and hot dip galvanized steel are very stable. However, the antenna should be inspected every 6 months.

- Inspect all fasteners. Tighten any loose fasteners. Replace any corroding fasteners.

- Inspect the foundation. Repair any cracks or damage with commercially available concrete repair materials. It the antenna is mounted to a steel superstructure, inspect the superstructure for corrosion and structural integrity.

- Inspect the fiberglass antenna reflector for cracks.

- Inspect the mount for rust.

- Inspect the feeds to ensure the assemblies are free from moisture, corrosion, insects, bird nests, or any other foreign material. Inspect connectors for proper seal and integrity. Any defective parts should be replaced immediately.

- Inspect the cables from the feeds into the headend to ensure that all connectors and components (such as line amplifiers) are in good working condition. Any defective parts should be replaced immediately.

4.1 FIBERGLASS MAINTENANCE

The fiberglass reflector should be cleaned and waxed periodically. A pressure washer works well for cleaning grime from the surface. A wipe on wipe off wax such as those used on automobiles works well for preserving the reflector surface and can help prevent snow from accumulating on the reflector's surface.

4.1.1 FIBERGLASS REPAIR

These instructions address three types of defects that appear on fiberglass antennas: crazing, cracking, and gel coat peeling. Crazing refers to hairline cracks that appear on the reflector's surface. These are usually caused by stresses in the material and are common. Unchecked crazing can develop into larger cracks, most commonly from moisture seeping into the crazing and being frozen. Crazing and cracks left unprepared can eventually result in gel coat peeling.

The reflective layer of the Simulsat fiberglass reflector is approximately 0.030" below the surface of the reflector. In general, the reflective material coincident with a crack will be ground away in order to prepare the area for repairing. Grinding away these small areas of the reflective material will not have a noticeable effect on the performance of the antenna.

Repairing fiberglass is not difficult, but if you prefer to hire someone more familiar with the job, many auto body repair shops and marine shops are familiar with repairing fiberglass.

4.1.2 CRAZING REPAIR PROCEDURE

Materials/Equipment:
Captain Tolley's Creeping Crack Cure, acetone, clean rags

Step 1
Prepare the area to be repaired. The repair area should be clean and dry. Clean the area with solvent(acetone or 1.1.1 Tricloroethane) and let dry 5 minutes. Do not use water. A compressed air blast can be used to remove dust and/or moisture from the repair area.

Step 2
Apply Captain Tolley's per the instructions on package. Re-apply as required until cracks are filled.

4.1.3 LARGE CRACK REPAIR PROCEDURE

Materials/Equipment:
Polyester repair putty (available at hardware and marine stores), acetone, plastic scraper, single edge razor blade or pocketknife, sandpaper, grinder, air compressor (optional), orbital sander (various grits sandpaper).

Step 1
Prepare the problem area. The repair area should be clean and dry before applying the repair putty. If the crack edges curl upwards, use the grinder to remove the material that deviates from the reflector's desired curvature. Grind material away from within the crack until mostly fresh, clean fiberglass is exposed. The repair putty will bond best to clean bare fiberglass. The reflector is nominally 1/4" thick. Take care to not grind all the way through it. Peeling gel coat should be peeled back and broken off. No unbonded gel coat should remain. Clean all repair areas with acetone, and let dry 5 minutes. Do not use water. A compressed air blast can be used to remove dust and/or moisture from repair areas.

Step 2
Mix some repair putty with catalyst and apply it to the crack. Screed off excess resin with the plastic scraper (a single edge razor blade works also). The putty should mound up slightly higher than the dish surface. Use an acetone dampened cloth to clean up putty around the repair. Let the putty cure. In general, the resin can be sanded within 20 minutes. If the repair area is on a steep incline, apply the putty and cover the repair area with masking tape to hold it in place.

Step 3
Sand the repair area as required to achieve the desired finish. Sand down to at least 280 grit. A disc sander will tend to gouge the surface. An orbital sander works well.

Step 4
Paint the repair using an acrylic enamel exterior house paint. It may be desirable to paint the entire reflector. ATCi strongly recommends against painting the reflector a color that is darker than the original color. Painting the reflector darker than the original color voids the warranty on the reflector.

4.2 STEEL MAINTENANCE

Any rust growth should be arrested promptly by removing all grease, rust, and any other undesirable films and painting the area. A good zinc-based primer (or spray-type cold galvanizing compound) and finish coat should be applied to any steel parts that require treatment.