



Antenna Technology Communications, Inc.

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OPTIMIZING SIMULSAT FOR DIGITAL SERVICE



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Overview

Digital video can present some new challenges for successful downlinking, whether the reflector antenna is a Simulsat or a parabolic.

In some cases, the parameters of the digital transmission itself can make reception difficult. For example, some digital transmissions are piggybacked within the spectrum of an analog transmission, which has the net effect of the analog signal acting as noise relative to the digital signal.

With satellites now located within 2 degrees of each other, adjacent satellite interference can cause more noise to impact reception. This can be accentuated as new satellites are positioned adjacent to older satellites. Newer satellites can potentially overpower ground station reception of older satellites to which they are adjacent. Transmitting ground stations can also transmit spurious lobes that create interference for earth stations receiving signals from adjacent satellites.

However, in most cases, if problems are encountered downlinking digital signals, careful attention to some important details can help to ensure the maximum performance possible. Following are factors that can contribute to digital reception problems and recommendations for addressing these problems. **Note:** Factors 1 and 2 are of particular importance and attention to these two issues can in most cases solve digital reception problems.

Potential factors for reception problems:

1. Feed Peaking

The most important factor impacting Simulsat performance is feed peaking. This has been the most important factor with analog service and is even more critical with digital service. ATCi has found that careful feed peaking using the right tools solves most digital reception problems.

2. LNB

The other factor that is of paramount importance when receiving digital services is the stability of the LNB. Digital services typically operate across very narrow bandwidths, and if the LNB is not sufficiently stable it can drift slightly off of the desired frequency, resulting in noise. Standard LNBs are stable within ± 1 or 2 MHz. Digital capable LNBs are stable with ± 500 KHz. High stability LNBs (PLL) are stable within ± 12 KHz.

3. Cabling

The cable from the feed into the head end and any components in that system can be sources of loss and/or ingress, which can negatively affect digital performance.



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4. Correct Simulsat Feedhorn

The feedhorn can be important for a couple of reasons. Older Simulsat feedhorns, (those purchased prior to 1990), were not designed for the 2-degree environment. All newer ATCi Simulsat feedhorns, (post 1990), are 2-degree compliant. This compliance is a function of the width of the feed assembly. A 2-degree compliant Simulsat feed assembly is 3.4" wide. The feedhorn consists of the horn itself (or scalar) and a small waveguide component (ortho mode transducer, or OMT) that separates the linear polarities into the vertical and horizontal components and is twisted to polarize the feed. The OMT is the device that is most responsible for cross-pol isolation and it is factory-adjusted by ATCi for VSWR. But by nature, OMTs perform variably across the frequency range. As such, it is possible that different OMTs will provide different levels of performance at particular frequencies. Additionally, if you suspect that you are using a non-ATCi tested/approved feedhorn, you may want to replace it with a factory feedhorn. Please contact ATCi for information on this.

5. Digital Receivers

Some digital receivers have settings for LO or HI gain. The HI gain setting requires a greater signal level coming into the receiver. Additionally, receivers also perform variably across a frequency range. Different receivers may provide different levels of performance at particular frequencies.

6. Reflector Shape

The gain of a reflector antenna is highly dependent upon the reflector conforming to the reflector's theoretical shape as closely as possible. A common approach for evaluating the reflector shape of parabolic antennas is to "string" the reflector, adjusting the reflector so that crossing strings attached to the perimeter of the reflector barely touch each other. Simulsat antennas are pre-assembled at the factory using a template to establish the desired shape, and the antenna has corner stabilizers that are affixed upon installation that act to maintain the desired shape of the reflector. However, if all other potential sources of problems have been exhausted, the reflector's shape should be evaluated.

The factors above are *internal* to the system. Following are *external factors* that can affect the system.

7. Terrestrial Interference

Terrestrial interference (TI) can degrade performance. Telephone microwave operates within the satellite spectrum. TI that ingresses into the system acts as noise, and it can cause the satellite receiver to seek the TI signal instead of the desired signal.



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8. Radar Interference

Earth stations that are near airports, military installations, or areas of heavy maritime activity may experience interference from RADAR and/or altimeter transmissions. These transmissions are out of band, but harmonics from them can create interference in the satellite spectrum.

9. Microwave Interference

Many types of microwave interference have been known to cause reception problems. Even some brands of older microwave ovens have been traced as sources of interference, when placed within range of an antenna and/or its receiving components.

10. Ignition Noise

Ignition noise from small gasoline engines, such as those used on lawnmowers or leaf blowers can be sources of interference. Ignition noise from older automobiles can also cause interference.

11. Cell Phones

Some brands of older cellular telephones operating at or near an antenna have been noted to cause interference.

12. Arc Welders

Arc Welders operating near an earth station can also cause interference.

Recommendations for addressing the above factors:

1. Simulsat Feed Peaking

Presuming the Simulsat reflector is properly aimed and aligned to the satellite arc, feed peaking is the most important factor governing the antennas performance.

The best gauge of Simulsat alignment is the locations at which feeds optimize within the feedbox. All feeds across the satellite arc should be able to move through the optimal location without running into the feedbox walls. If while peaking a feed, it is seen to run into a feedbox wall without a drop in performance, it is possible that the reflector requires alignment. Should you encounter this condition, call ATCi for instructions on re-aligning the reflector; or call ATCi to obtain a quote to have an ATCi Engineer perform a service call and re-align the reflector.

In most cases, the Simulsat reflector is properly aligned and all that is required is careful peaking of the feed. If a high stability LNB is not being used for the feed, the LNB (or LNBs) should be replaced with a digital quality LNB, preferably a PLL LNB. Also, if the feed is needed in a 2-degree adjacent satellite environment, verify that the feed is 2-degree compliant by measuring the width of the entire feed assembly. A 2-degree compliant feed is 3.4" wide



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Peaking a Simulsat feed, of course, entails going up to the feedbox, either by lift or by ladder and manually positioning the feed for optimal performance. The best way to accomplish this is by having a spectrum analyzer up in the feedbox to provide instantaneous feedback as to the feed's performance as it is peaked. (Call ATCi for information and pricing on portable spectrum analyzers that are ideal for feed peaking.) With the feed connected to the spectrum analyzer, the feed can be moved side-to-side (fine azimuth adjustment), up-and-down (fine elevation adjustment), and in-and-out (focal length adjustment) systematically until the optimal location is acquired. The feed must also be optimized for polarization. The best performing feed location is not always the location where the gain of the desired signals is at their highest. The best location is frequently where the difference between the desired signal gain and the adjacent noise level (which is usually adjacent satellite co-pol in 2-degree environments) is greatest. A videotape of step-by-step feed peaking instructions is available from ATCi.

It is worth noting that for digital reception, the focal distance adjustment of the feed (in-and-out) becomes more critical compared to analog reception. The nature of the Simulsat is that it doesn't focus energy to a single point like a parabolic reflector. Rather, it focuses energy to a small, localized area, (roughly similar to a focal point), but somewhat larger and somewhat less coherent. As such, the feed can generally be moved in and out with little noticeable result, particularly with analog reception. However, with digital reception, the focal distance adjustment can be more critical. Additionally, occasionally the optimal feed location in focal distance has been found further away from the reflector than a normally configured feed assembly can reach. If this is encountered, the feed assembly can be reconfigured to allow adjustment farther from the reflector. Call ATCi for assistance, if you encounter this condition.

One step that can yield positive results is to swap the OMT portion of the feed for another OMT. As stated above, OMTs by nature perform variably across their operating frequency range and it is possible that using a different OMT might perform slightly better at a particular frequency. Finally, please check with ATCi if you suspect that you are encountering a non-ATCi manufactured/approved feed assembly on the Simulsat. Although they are very uncommon, ATCi occasionally sees other types of OMTs/Feeds being used on a Simulsat; and the success is very limited with these – particularly with digital services.

2. Cabling and Connectors

The line from the feed into the head end (IFL) should be as efficient as possible. If the cable and connectors are old, new cable and connectors should be considered. ATCi recommends new generation 100% compression connectors. If the run from the antenna into the head end is lengthy, RG-11 or even hard line may be required. In many cases, Simulsats use a high quality quad shield RG-6 from the LNBS to the base of the antenna and transition to high quality quad shield RG-11 (or in some cases, hard line) for the remainder of the run into the head end. In some cases, in order to preserve signal as much as possible, RG-11 is used all the way from the feed connection. This can be a little unwieldy, but it may be necessary.

If a line amplifier is required, only high quality line amplifiers should be used; and care should be taken to install them in a position along the line that doesn't result in the amplifier overdriving the front end of the satellite receiver.



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3. Satellite Receivers

If the receiver has HI and LO gain settings, set the receiver for LO gain. Additionally, similar to the OMT, receivers perform variably across their operating frequency range. Changing to a different receiver may yield positive results.

4. Terrestrial Interference

If an outside source of interference is suspected, filtering and/or shielding is often successful. Call ATCi for information.

5. Reflector Shape

If the shape of the reflector is in question, a site visit may be required. Call ATCi for information.

If you attempt the above solutions and are still having problems, please call ATCi Engineering at 480-844-8501. And if needed, ATCi can provide analyzers, PLL LNBS, filters, connectors, cable, etc; and can also provide experienced and qualified field service.