APPLIED INSTRUMENTS, INC.

TELECOMMUNICATIONS INSTRUMENTATION

Application Note

LNB Polarity Adjustment Using the SAT 9520

Satellite transmission systems use polarized signals to allow overlapping two separate signals in the same frequency range. There are two types: horizontal/vertical and circular or helical polarity. The horizontal/vertical type uses a 90 degree polarity shift to maximize the differentiation between the two signals. The receiving antennae for these systems use an LNB (low noise block amplifier) that has two detectors mounted with a 90 degree relative offset. The LNB must be adjusted to align the detectors with the satellite transmitter polarity. The optimal alignment will minimize the power received by each detector from the signal with the opposite polarity or equivalently, will maximize the rejection of the undesired polarity.

Spectrum Analyzer View

The effect is easy to see using a spectrum analyzer connected to the output of the LNB in a way that lets you select which polarity to view. Polarity is typically selected by supplying either 13 volts or 18 volts to the LNB.

When a system is adjusted perfectly and you toggle between polarities, the separate polarities will be distinct. With an imperfect adjustment, the opposite polarity will carry over into the selected polarity. The amount of carry over depends on the degree of misalignment.

Consider the following illustrations depicting possible spectrum analyzer views. Note how in the Figure 3, showing imperfect rejection, the undesired vertical transponder signals add to the desired horizontal transponder signals.

If you can watch the spectrum analyzer as you adjust the polarity to its optimum setting, you would see the undesired vertical polarity signals decrease until they are no longer visible and the view would resemble Figure 1.

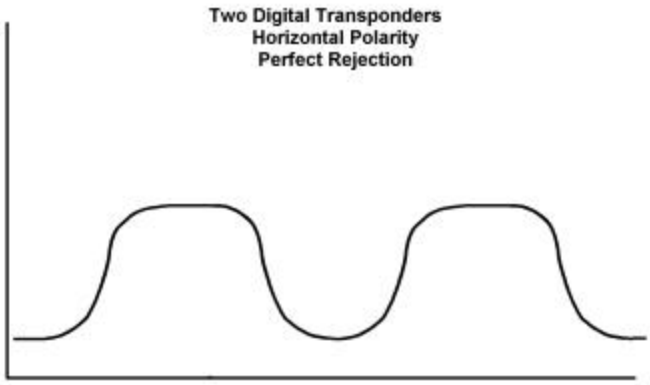

Figure 1

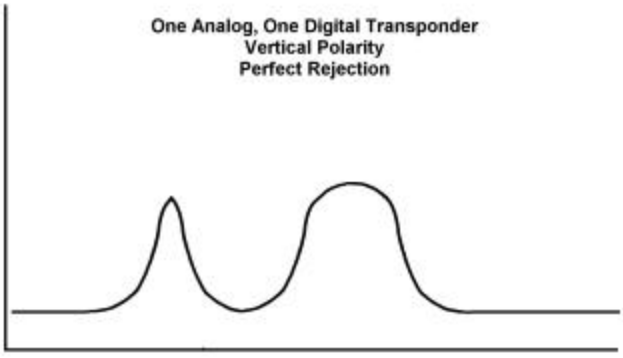

Figure 2

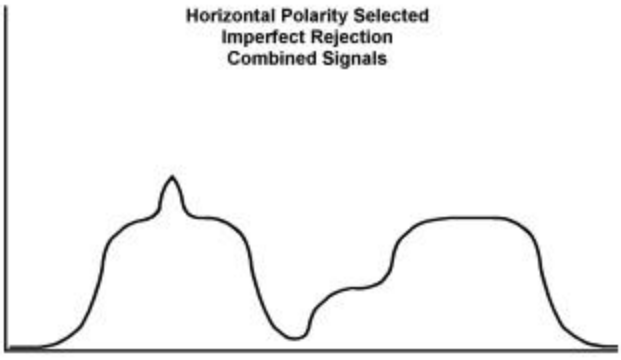

Figure 3

SAT 9520 View

To the SAT 9520, the undesired polarity signal looks like noise. It therefore shows up in the Carrier To Noise (C/N) measurement by decreasing the C/N ratio.

The polarity can be optimized by using the SAT 9520 to monitor the C/N ratio and adjusting the LNB to maximize the C/N ratio. This works best in a situation like the right side of the figures above, at a frequency where digital carriers are present in both polarities with offset center frequencies but overlapping bandwidths.

It does not work well at a frequency where the opposite polarity has no signal within the bandwidth of the SAT 9520's receiver (27 MHz) because there will be no signal to carry over as noise no matter how poorly the polarity is adjusted. It will also work best on a signal which the SAT 9520 is capable of locking onto. You should inspect the frequency plan for the satellite you are using to determine the best transponder to use for adjusting the polarity.

The SAT 9520 has two advantages over a spectrum analyzer in adjusting the polarity: price and portability. A spectrum analyzer makes it easier to see what is going on, but the SAT 9520 is easier to carry up on the roof.

C/N Peaking Tone

The SAT 9520 provides an audible tone for peaking the C/N that is very similar to the audible tone used for peaking the power level.

1) Press the  button to turn the audible tone on. This puts it into power level peaking mode and a speaker icon will flash next to the signal level reading to indicate the tone applies to the signal level.
2) Press the 

button to switch to the C/N peaking tone. The speaker icon will now flash next to the C/N reading to indicate the tone now applies to the C/N reading.

The C/N peaking tone uses the same beeping pattern as its level peaking function.

1) A slow beep will be heard until more than 4 dB of C/N is obtained.
2) A solid tone will be heard when the C/N is within 0.4 dB of the highest peak detected since the RUN button was pressed or since a lock was obtained.
3) A fast beep will be heard if the C/N drops more than 0.4 dB from the peak but is still above the base of 4 dB.

Adjusting Polarity

The azimuth and elevation should be adjusted before adjusting polarity.

1) Perform a rough adjustment of the polarity using the adjustment scale on the LNB and a setting obtained from the manufacturer's tables or previous experience or some other source. The setting will depend on your location. If you cannot determine an initial setting, use zero.
2) Turn on the LNB power and the C/N peaking tone as described above.
3) Observe the C/N measurement. If you have good signal and are approximately aligned, you should have a C/N greater than 4 and a solid tone should be heard. If your C/N is less than 4 you might need to readjust the azimuth and elevation or select a different transponder to peak on.
4) SLOWLY rotate the LNB in one direction and observe the effect on the C/N reading. The audible tone will give you some feedback, however, you may also want to watch the readings

on the display. The C/N measurement is a bit slow to respond so you need to rotate the LNB is small increments and give the SAT 9520 time to respond.

5) If the C/N is improving (solid tone stays on), keep rotating in the same direction. When the C/N starts to decrease (tone starts beeping), note the position on the adjustment scale and then start rotating in the opposite direction.
6) Again watch (and/or listen to) the C/N as you SLOWLY rotate the LNB back the other way. Once you return to the previous peak, the solid tone should come back on. Keep rotating until you move past the peak (tone starts beeping again) and again note the position on the scale.
7) The optimum position should be midway between the two points noted above. Rotate the LNB back to the halfway point and verify that the C/N is now maximized (the solid tone should be back on).

You can also observe the IRD signal quality bar graph which includes a peak line and present value line. Since the IRD signal quality is directly related to C/N, maximizing this measurement will also maximize the C/N.

Summary

The polarity adjustment is an important part of a proper installation for systems using horizontal/vertical polarity signals. The SAT 9520 provides an easy, affordable method for properly adjusting the polarity without the need for additional equipment or assistance.