Evaluating ADL System Iridium Performance

Version 1.00

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1 Version History

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2 Page Index

This manual contains numbered pages 1 to 11.

3 Overview

This manual was written to help you evaluate the performance of your ADL device Iridium satellite signal. This manual applies to all ADL devices: ADL110B, ADL120, ADL130, ADL140, ADL150(b), ADL190, ADL200. For other aspects besides the Iridium signal strength please refer to the user and installation manuals.

4 Iridium System Description

The Iridium satellite network uses a network of low earth orbit satellites. The satellites fly approximately 781 km over the surface of the Earth at approximately 27000 km/h. This results in about 100 minutes for one orbit.

This design has got some direct consequences for the users of the ADL in flight weather system. **The satellites will move rapidly and the fact that at one time there was Iridium reception at a specific location does not mean this will be the case a few minutes later.**

For continuous reception on the ground Iridium says the antenna should have a 360 ° view of the sky 8° above the horizon. The satellites move North to South or South to North. This means that obstructions to the North or South usually result in shorter but more frequent interruptions. Obstructions to the East or West usually result in much longer but also less frequent interruptions.

5 Iridium Reception in Aircraft

In nearly all aircraft installations a perfect reception will not be possible or affordable. The ADL system was designed with this in mind and the ADL device will just pause for a moment until the satellite is back in view. So while perfect reception is not required we are looking for good average signal strength with some accepted short duration interruptions. **A single observation at one moment in time will never be enough to judge the quality of the installation. The long term average is what matters.**

6 Link between Iridium and GPS Signal

For all ADL devices except the ADL140 the Iridium and GPS receiver share the same antenna. The signal frequencies are very close to each other but the GPS satellites are in a much higher orbit. Thus, many more GPS satellites will be in view at any time. In general for situations with poor antenna placement the device will pick up a GPS signal more easily than an Iridium signal. But if both signals, Iridium and GPS, are for example

constantly zero bars / red cross this is a direct indication for an antenna or cable problem.

7 Monitoring Iridium Signal Strength

When running the ADL device please open the ADLConnect app. You will get the following indications:

- Current Iridium and GPS signal strength. Both go from zero bars / red cross to 5 blue bars. Please note the Iridium signal is picked up within seconds after booting the device. The GPS signal on the other hand can take one or more minutes until enough data was received. So the Iridium signal strength indication is basically real time while the GPS signals strength indication has got significant delay.

- At the bottom of the Config page you will find the average Iridium and average GPS signals bars since powering up the device.

- When running firmware 8.53 or later on the message window at the bottom of the download page two lines will appear:
"GPS first fix" This indicated the device has got the first GPS fix since booting up
"Iridium first full signal" An Iridium signal strength of 5 bars was detected for the first time after booting up the device

8 Expected Iridium Signal Strength

The longer you run the ADL device the more precise the values will be. Usually one hour gives very precise results while running the ADL device shorter than that already gives a clear tendency. There is no need to connect the iPad to the ADL device during this period unless you want to see the results. The device will monitor the signal automatically once powered up.

On a typical installation you can expect the following values if the aircraft is in flight or outside far away from any hangars or other obstructions.

- "Iridium first full signal" at least once. The signal will always fluctuate but at some point with view a good view to the satellite full 5 bars should be detected

- "GPS first fix". In most case less than 1 minutes after booting the device, in some rare cases up to 5 minutes

- Iridium AVG 2 bars or more

- GPS AVG 3-4 bars or more

If the plane is close to a hangar our experience is that you can usually expect 1 Iridium bar on average only. An external Iridium antenna on the hull usually increases the average by about 1 bar. On a "perfect" installation the best we did observe so far in flight was Iridium AVG 4-5 bars and GPS AVG 5 bars.

Below you find some sample screenshots.

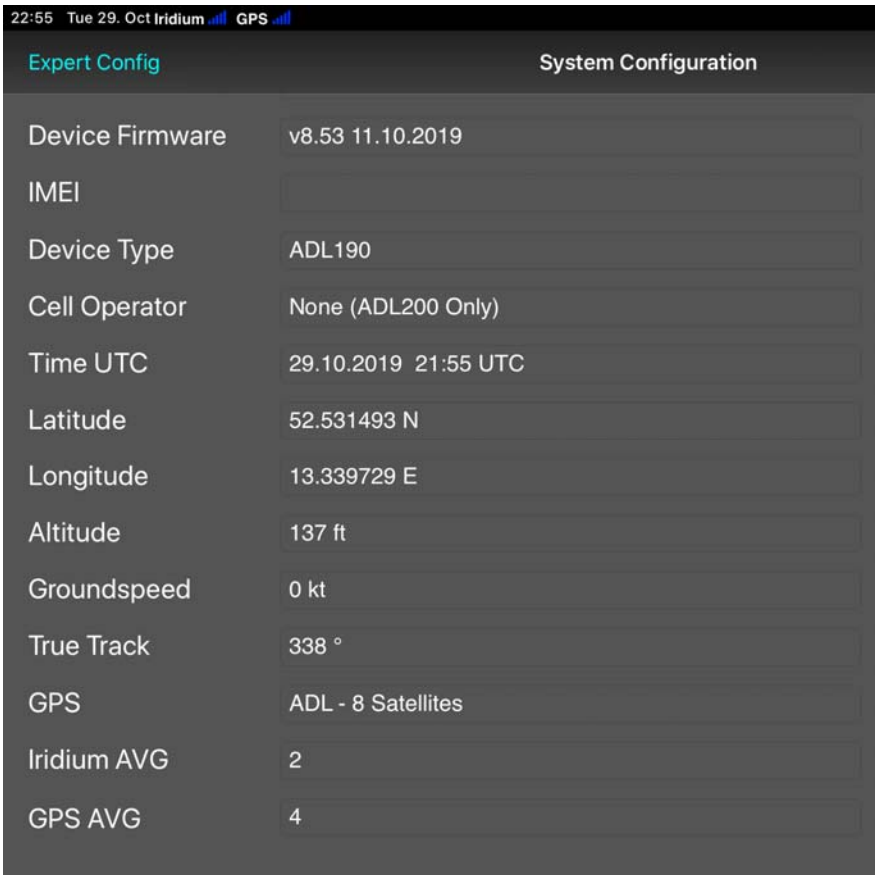

Figure 1 An example of standard performance Iridium AVG 2 / GPS AVG 4

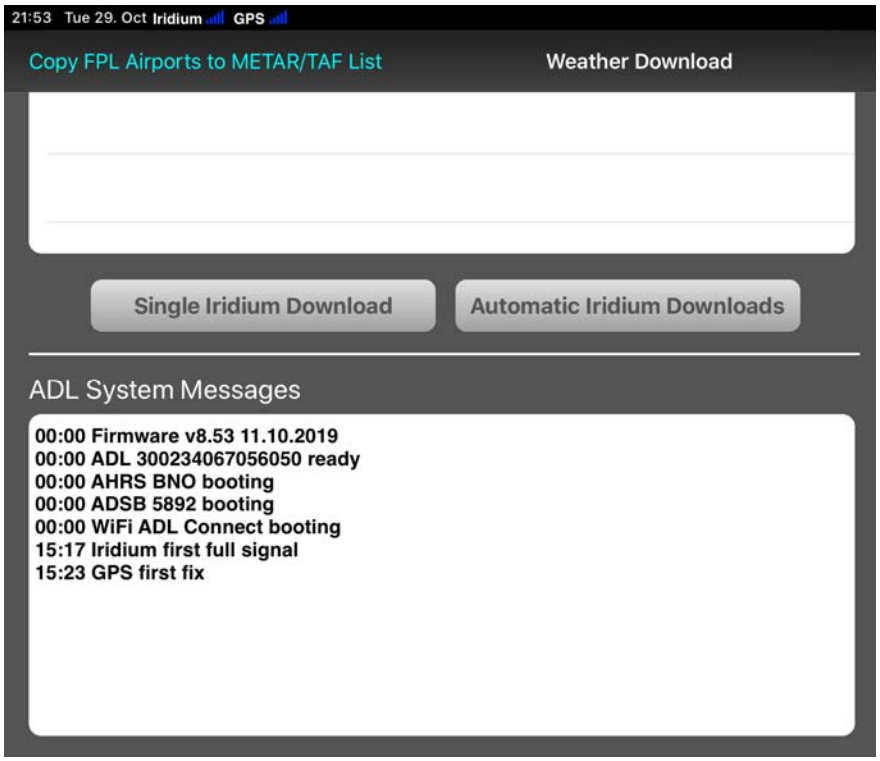

Figure 2 Firmware 8.53 announcing the first GPS fix and the first Iridium 5 bars

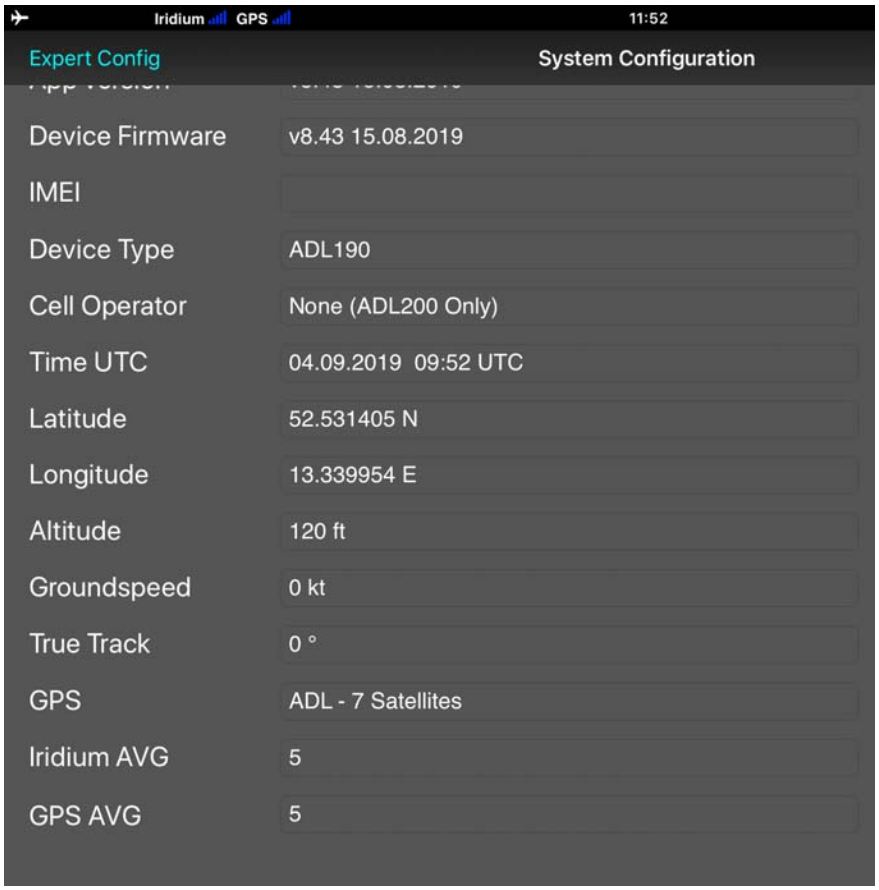

Figure 3 The theoretical best case Iridium AVG 5/ GPS AVG both 5 bars, but this is never attained over a longer period of time

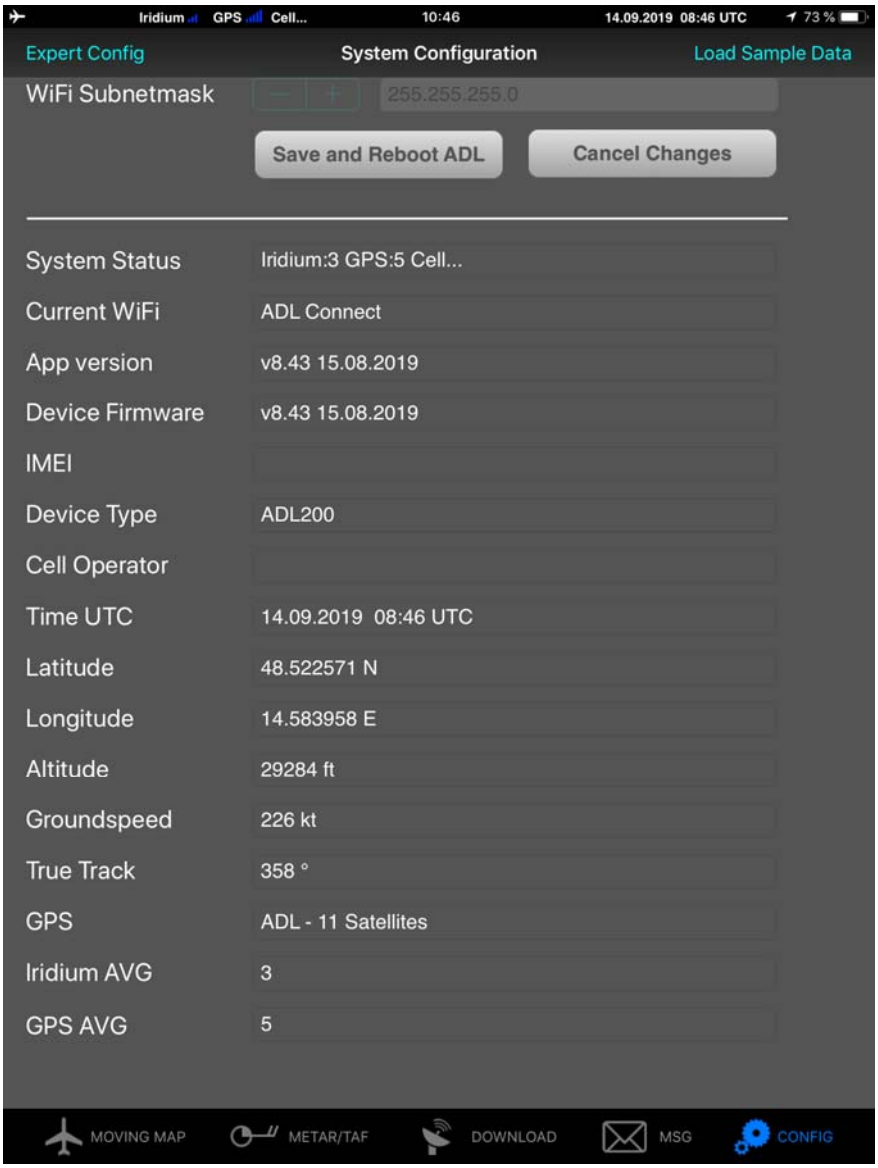

Figure 4 An example of very solid performance obtained in flight on our own aircraft.

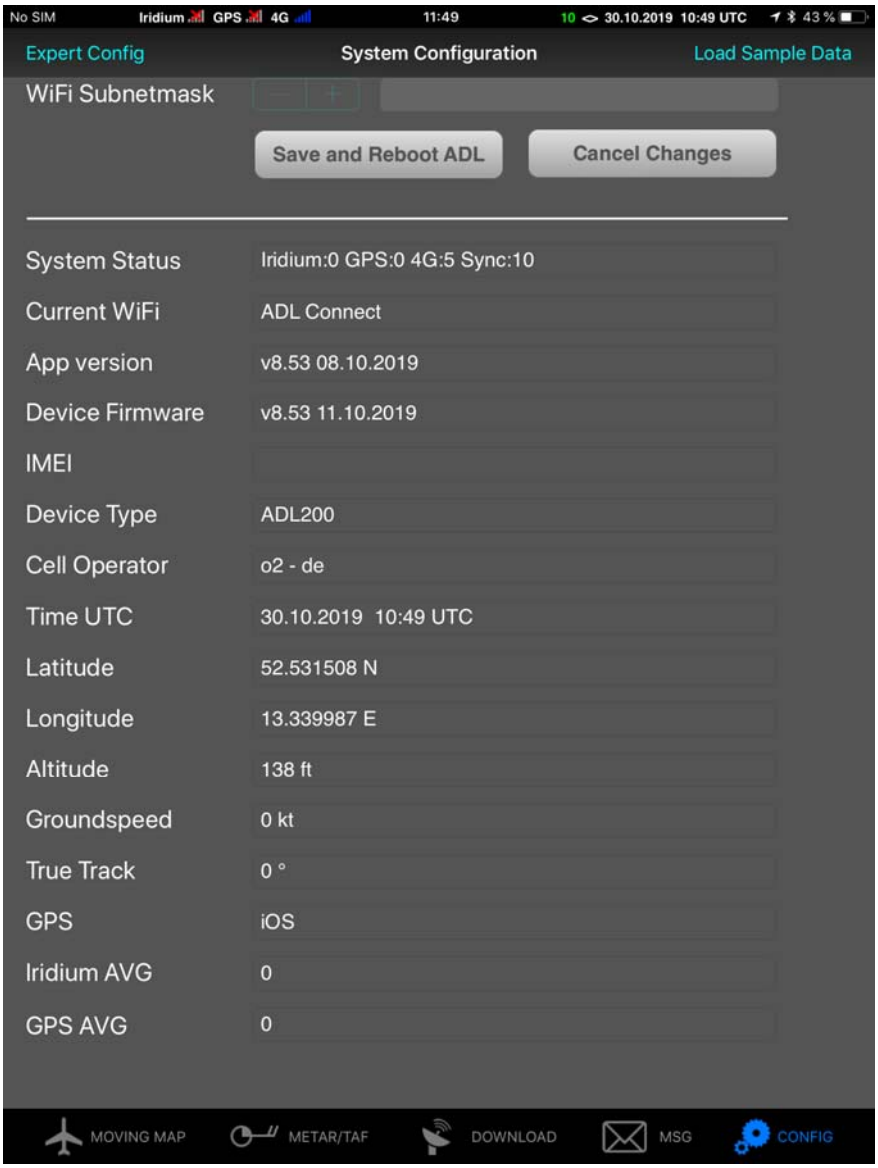

Figure 5 An example of very poor performance which needs investigation

9 Troubleshooting

If the detected performance is below the values indicated above we suggest checking those items in this order:

9.1 Iridium antenna connector

Except for the ADL140 the single most common defect relates to the Iridium antenna connector. If there was too much tension on the cable the SMA connectors can get damaged. We have also seen tiny dirt particles in the connectors causing signal loss. The most crucial point is the tiny central pin which should not be retracted or similar. Besides that please check the cable for any tight bends or other defects. Sometimes just reattaching the connector solves the problem.

Figure 6 SMA connector with properly located center pin

9.2 Iridium Antenna Cable Length

Up to about 4 m RG174 cable seems to be sufficient. Above that we recommend to try lower loss cable like RG400.

9.3 Iridium Antenna Orientation

The patch Iridium antennas we use have to be oriented towards the sky. They radiate only to one direction so please make sure the antenna is not upside down. Also the antenna should be as horizontal as possible. For example tilting the antenna 90 to the side will result in massive signal loss for all situations when the satellite is on the other side.
As the ADL140 contains the antenna in that case the orientation applies to the whole ADL140 device where the black sticker should face downwards.

Figure 7 Proper Iridium antenna orientation (left side)

9.4 Iridium Antenna Location

Depending on the cockpit layout different locations for the antenna can be chosen. The following materials are known to block the signal:

- Electrically heated windshields with fine wires in the glass usually shield the signal, so try not to place the antenna below such a windshield

- Any kind of metal above the antenna will shield the signal

- Composite materials will shield the signal if carbon fiber or embedded metal is used

- Electrically heated windshields which use a conductive coating instead of fine wires are known to cause the worst signal loss. Often below such windshield not even GPS reception will be possible

Unless any special obstruction in the cockpit requires another solution, we have found that the best place for the internal Iridium antenna is all the way forward below the windshield more or less in the middle of the aircraft.

Figure 8 Typical Iridium antenna location in that case slightly right of centerline but still acceptable

9.5 Iridium antenna defects

We have seen faulty Iridium antennas but they are rare. In most cases the cable or connector are the source of the problem.

9.6 ADL Device Defects

Finally we have also seen ADL devices which did not perform properly. If you suspect such a defect please contact us. We can bench test the device or provide another device for tests.

10 Contact

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