

108185 Antenna Switch with GNSS

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Background

This board is intended to replace the function of the antenna switches and GPS that were contained in the R600 Emergency Board 102376. The 102376 Emergency Board included a Garmin GPS and several RF relays that could connect either off-board Iridium radio or on board GPS radio to a single 1600 MHz antenna. The relays could also isolate that antenna, to facilitate locating a ground fault. The relays could also isolate the WiFi antenna from the WiFi radio. The large 102376 Emergency Board is no longer used with the new REMUS Core-based vehicles, so this new board was created.

Improvements

The new board is intended to provide not only GPS, antenna multiplexing for Iridium, and ground isolation for two antennas, but also replace the external low noise amp (GPS Source A11T-BDC-SF) that was used with the 102376 Emergency Board, minimizing number of parts in the chassis. The new GPS is uBlox NEO-M8Q, which integrates an additional internal LNA so it can be connected directly to a passive antenna. Instead of connecting the antenna to a panel-mount SMA coupler mounted at the end of the chassis, and then cabling this coupler to the Emergency Board, the new board can be mounted directly to the end of the chassis and antenna connected directly. The new configuration minimizing the number of devices in the chassis and the number of cables and connectors.

The new board uses SMA RF connectors which are preferred over MMCX for their ruggedness and ease of installation and maintenance. The end-launch SMAs can be fastened to the chassis, minimizing board flex during connection and disconnection of RF cables.

Iridium multiplexing is provided by a mechanical RF relay, selected for its high power handling capability, necessary for Iridium transmit. To minimize power consumption in the relay coils, the relay is a latching type, so only a short pulse of current is necessary to hold it in one state or the other. The antenna ground-isolation switches, on the other hand, are not mechanical. They are instead simple FET switches which block or pass DC current to each antenna. The isolation switches are coupled to bias tees tuned for Iridium/GPS (1.6 GHz), and WiFi (2.45 GHz). With this new configuration, the GPS, Iridium and WiFi continue to function whether or not the antennas are isolated, making interactive ground-fault searches more convenient.

The new antenna switch board is designed to use the 3.3V CMOS outputs provided by the Core board 106872, and the 5V antenna switch power supply provided by the Core board. GPS is powered by the 28V switched output from the GPS Core port.

The new GPS, uBlox NEO-M8Q has more options than the Garmin. It tracks Russian, Japan, and China satellites. It offers higher baud rates and more available NMEA messages including ZDA which is used by several sensors. The PPS output also has many possible options.

Signals and Bits

J3 Antenna Switch Pin Number	Core Board J36 Signal Name	Antenna Switch Function	Core Idle State	Core GPS State	Core Iridium State
1	ANT_CTL_1	Select Iridium. Disconnect GPS.	0	0	1
2	ANT_CTL_2	Test GPS/Iridium Antenna. Propagate antenna ground fault to GF detector.	0	0	0
3	ANT_CTL_3	Test WiFi Antenna. Propagate antenna ground fault to GF detector	0	0	0
4	ANT_CTL_4	Not used.	0	0	0
5	ANT_CTL_5	Not used.	0	0	0
6	ANT_CTL_6	Not used.	0	0	0

In normal operation under control of the Zynq CPU, pins 2 and 3 would normally be high so that ground faults are detected. In normal operation, the antenna switch states would therefore be 0x06 for GPS and 0x07 for Iridium.

The Core board in Emergency mode does not detect ground faults, so bits 2 and 3 will be zero when the Core PIC is controlling the vehicle.

However, in normal operation the user should have interactive control of bits 2 and 3. So 8 states are possible during normal operation under control of the Zynq CPU:

0 = GPS selected. Both antennas isolated. Ground faults not detected.

1 = Iridium selected. Both antennas isolated. Ground faults not detected.

2 = GPS selected. GPS antenna not isolated. WiFi antenna is isolated.

3 = Iridium Selected. GPS antenna not isolated. WiFi antenna is isolated,

4 = GPS selected. GPS antenna is isolated. WiFi antenna is not isolated.

5 = Iridium Selected. GPS antenna is isolated. WiFi antenna not isolated.

6 = GPS selected, all ground faults detected.

7 = Iridium selected, all ground faults detected.