LADEE Moon Probe Sighting

I have my doubts on how accurate this approach is, but the idea is to find where the line from the direction defined by

R.A. 23h05m47.4s, Declination -31d46.1'at 2013 Sept 7, 03h 30m 28s Z through the point

Latitude 37.41, Longitude -69.43, Altitude 161.99km intersects the earth's surface. See figure.

With the given numbers, I come up with N 42.0477, W 71.1326

