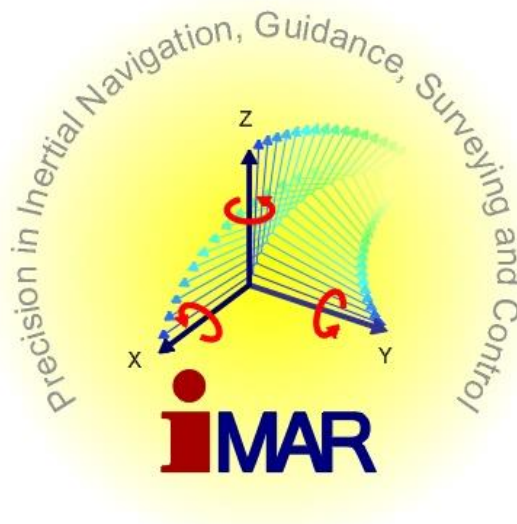


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Bicycle, E-Bike and Pedelec Testing using an i μ VRU

Commercial-in-Confidence



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1 SETUP DESCRIPTION

This report shows the testing of bicycles, E-Bikes, Pedelecs or Motorcycles using an easy to use inertial measurement system of type i μ VRU.

Background of the described test setup is the request from the manufacturers of such vehicles, to test their ABS and active damping system. An important challenge is to provide a very easy to use setup, which is applicable within only a few minutes.


So iMAR provides with its i μ VRU the appropriate reference measurement with following features (see i μ VRU documentation for extended information):

<u>Requirement</u>	<u>iμVRU</u>
• Low weight and size	→ only 50 grams
• Low power dissipation	→ less than 2 W, supplied via USB connector
• High bandwidth	→ 200 Hz data rate
• Inertial sensors	→ 3 x gyros and 3 x accelerometers integrated
• GPS interface	→ GPS receiver integrated
• Baro height	→ barometer integrated for height profile measurement with < 30 cm resolution (better than GPS!)
• Optional wheel sensor	→ odometer interface available as an option (not required for standard motion testing)
• Output of all motion data	→ roll, pitch, heading, 3D position and 3D velocity, angular rates and acceleration in 3D
• Easy to use interface	→ USB, CAN and RS422 UART
• Signal processing	→ integrated advanced Kalman filter for providing best online results

The following picture shows a setup on a bicycle.



Figure 1: Mountain Bike with installed reference measurement system i μ VRU

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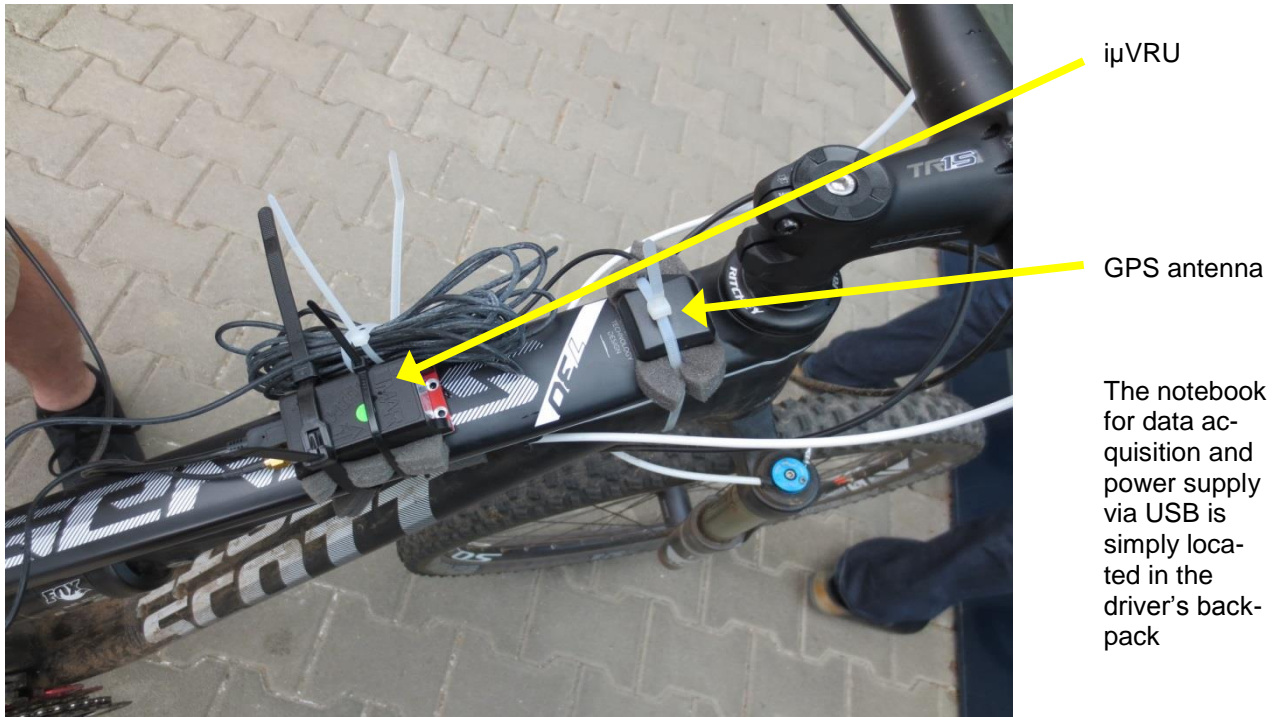



Figure 2: i μ VRU and GPS antenna mounted on a Mountain Bike

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2 EXAMPLE DATA

The following plot shows as an example the online measured roll and pitch angle of a Mountain Bike during a test trial over time (7 minutes test trial).

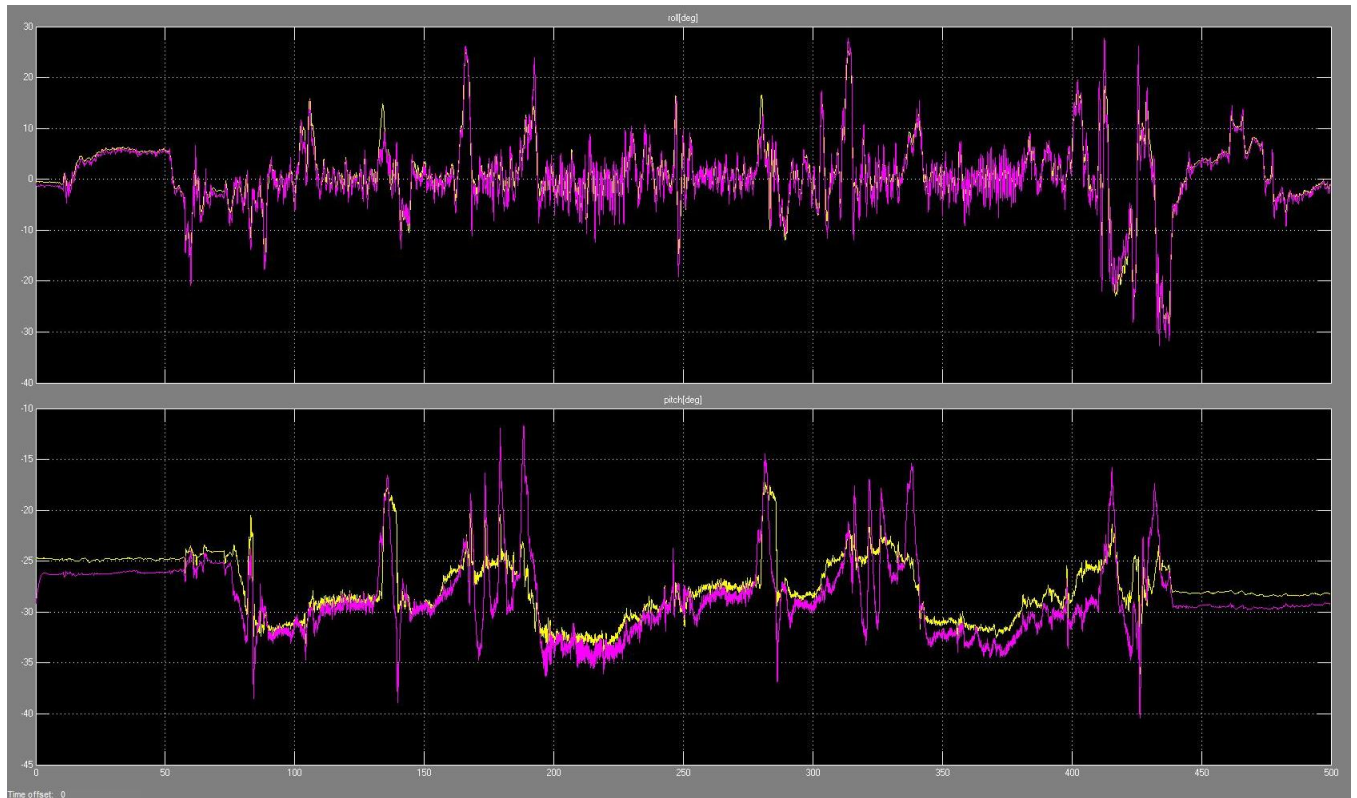


Figure 3: Test results from a real world test on a bicycle

The yellow line is the measurement from iMAR's reference system iμVRU.

The pink line is the output of an assistance system (DUT [device under test], which shall be verified by using iMAR's iμVRU) being applied on the bicycle from the bicycle's manufacturer.

It is easy to see that the applicant's DUT especially on pitch angle has significant disadvantages under real world's motion (always if the bicycle is accelerating or braking).


Such behavior of the DUT can be easily and fast analysed using iMAR's iμVRU with it's integrated advanced "plug & play" realtime signal processing.

3 BATCH PRODUCTION OF GYRO SYSTEMS FOR BICYCLES

Beside of the reference system iμVRU iMAR also offers the design and production of highly integrated INS/GNSS systems, being specifically optimized for the mass market of bicycle / E-Bike / Pedelec integration .

iMAR is also available to provide consultancy for inertial measurement and control system design and optimization.

Contact our sales engineers for further information!

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4 SUPPORT

4.1 Asking for Support

For our support management system, we need to know the project number (Proj.No.) or alternatively P/N and S/N of the system you are speaking about.

These numbers are for example provided on the type plate (example shown in the Fig. on the right side).



Fig. 4-1: Example iMAR type plate

4.2 Contact

You can find general information about our products, used technologies, and about inertial navigation, and GNSS based navigation at www.imar-navigation.de.

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