

RT3000 : Phase/Gain Study

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NA

1. INTRODUCTION

Ricardo uses an RT3000 GPS aided inertial navigation sensor as part of its vehicle dynamics objective measurement (VDOM) equipment.

This report describes an investigation performed to examine the phase and gain characteristics of the RT3000 sensor as a function of frequency.

2. OBJECTIVES

- Quantify any phase lag and frequency dependant gain effects introduced by the RT3000 sensor.

3. TEST SET-UP

This investigation was conducted using a Ford Focus RS as the test vehicle

The test vehicle was fitted with the following instrumentation:

- Oxford technologies RT3000 sensor (serial number 0024) (integrated CAN)
- DC Accelerometer mounted to the side of the RT3000 unit oriented to measure lateral acceleration (analogue input to acquisition unit)
- Datron micro-EP5 acquisition unit

Frequency response tests were conducted at 30mph with the RT3000 configured both in single and dual antenna modes. Five minutes of data per configuration was recorded. Lateral acceleration was examined as it is a channel that can be easily replicated by an external sensor with a known phase and gain characteristic.

4. DATA ANALYSIS AND RESULTS

Test data was corrected for measured static transducer offsets from the zero steer condition, but not filtered to remove noise. Data was analyzed in the frequency domain using the Turbolab function 'transfer' set to 2048 point averaging with a rectangular window. Mean amplitude, phase and coherence are extracted and displayed against frequency. Input frequencies for this test were limited by driver capability to 3Hz.

Results are plotted on the following pages. The plots show the transfer function between the accelerometer signal and A_y signal from the RT3000. Test runs for single and dual antenna runs are shown.

Both graphs show no frequency dependant gain variation between the accelerometer and the RT3000. However, they do illustrate linearly a increasing phase lead with frequency for the external accelerometer signal compared to the RT3000. The DC accelerometer used for this testing was calibrated prior to testing and showed no phase lead/lag characteristics in the frequency range examined.

Frequency Response Test

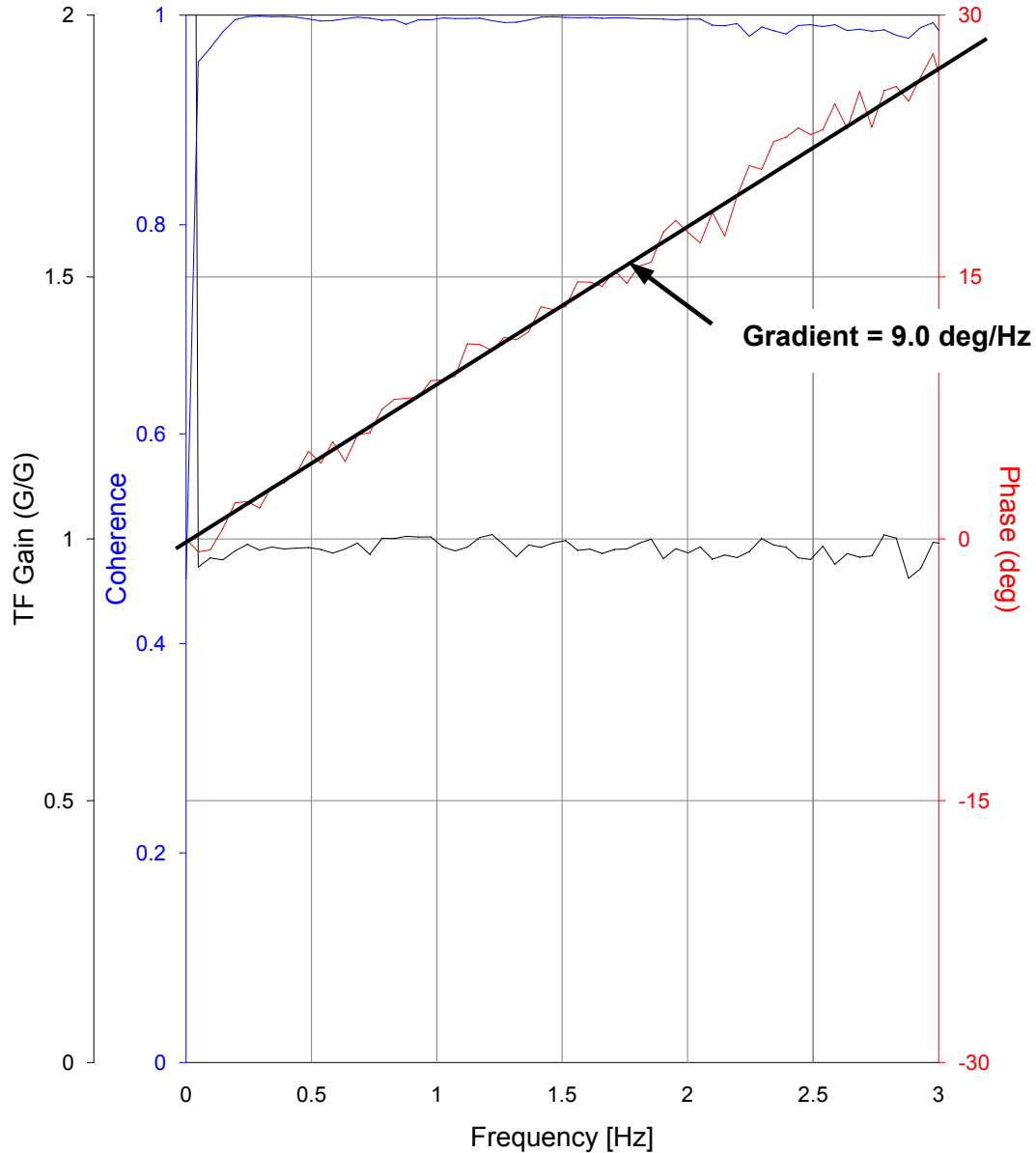
Test vehicle : Ford Focus RS

Date : 15OCT03

30mph

Files Used:	F_R_808.dol	F_R_812.dol
J: \ Data \ VDOM \ 15OCT03 \	F_R_809.dol	F_R_813.dol
zero_218.dol	F_R_810.dol	
zero_219.dol	F_R_811.dol	

Graph 1: TF of External Accel Signal to GPS Ay (CAN)(Dual antenna)



Frequency Response Test

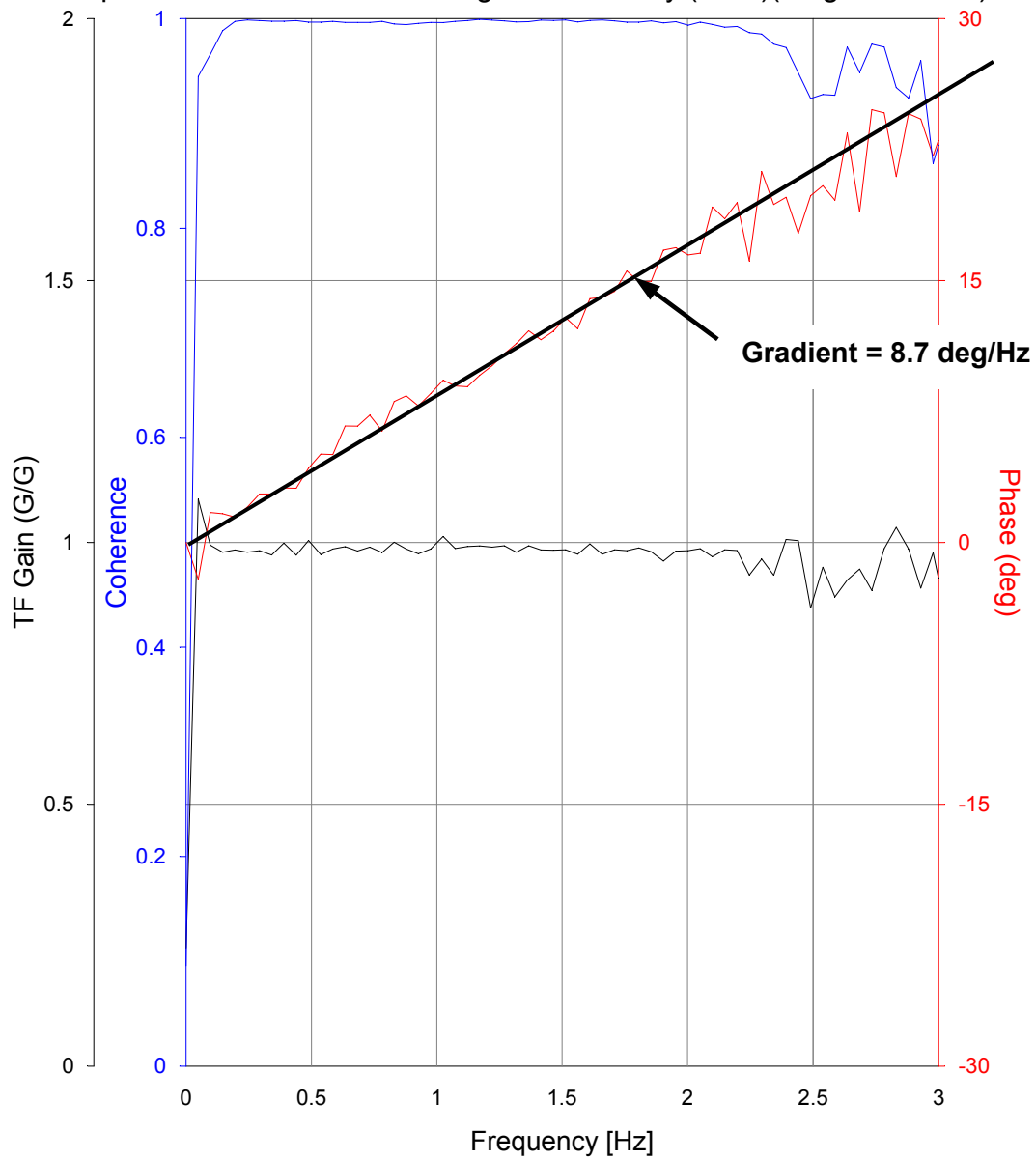
Test vehicle : Ford Focus RS

Date : 15OCT03

30mph

Files Used:	F_R_900.dol	F_R_904.dol
J: \Data \VDOM \ 15OCT03 \	F_R_901.dol	F_R_905.dol
zero_218.dol	F_R_902.dol	
zero_219.dol	F_R_903.dol	

Graph 1: TF of External Accel Signal to GPS Ay (CAN)(Single antenna)





5. CONCLUSIONS

The data suggests that the RT3000 induces a linear phase lag equal to 9 degs per Hz in both single and dual antenna configurations in the Ay signal. There are no changes in signal gain with frequency.