NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

Technical Memorandum 33-487

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Use of Centaur Spacecraft Flight Data in the Synthesis of Forcing Functions at Centaur Main Engine Cutoff During Boost of Mariner Mars 1969, OAO-II, and ATS Spacecraft: Computer Plots

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N71-32571 (ACCESSION NUMBER) 65 (PAGES) CR-119693 (NASA CR OR TMX OR AD NUMBER)

(THRU) G3 (CODE) 31 (CATEGORY)

FACILITY FORM 602

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CALIFORNIA INSTITUTE OF TECHNOLOGY

PASADENA, CALIFORNIA

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June 21, 1971

Prepared Under Contract No. NAS 7-100
National Aeronautics and Space Administration

PREFACE

The work described in this report was performed by the Engineering Mechanics Division of the Jet Propulsion Laboratory.

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I. INTRODUCTION

Volume I of this report deals with the analysis for the determination of the plotted functions presented in this document. Figures A1 to A54 herein represent acceleration flight data of five Centaur Main Engine Cutoff (MECO) events and selected gimbal axis forcing functions. The Centaur flight numbers and associate spacecraft are given in Table 1. The Centaur gimbal axis forcing functions for the two Mariner Mars '69 flights (Mariners VI and VII) derived from the corresponding field joint acceleration flight data are presented. Selected components of the forcing functions derived from acceleration flight data for the OAO-II and ATS spacecraft are also presented.

Table 1. Centaur Flight Numbers, Associated Spacecraft Vehicles and Launch Dates

Flight	Spacecraft	Launch date
AC-16	OAO-II	Dec. 8, 1968
AC-17	ATS	Aug. 10, 1968
AC-18	ATS	Aug. 12, 1969
AC-19	Mariner VII	March 27, 1969
AC-20	Mariner VI	Feb. 25, 1969

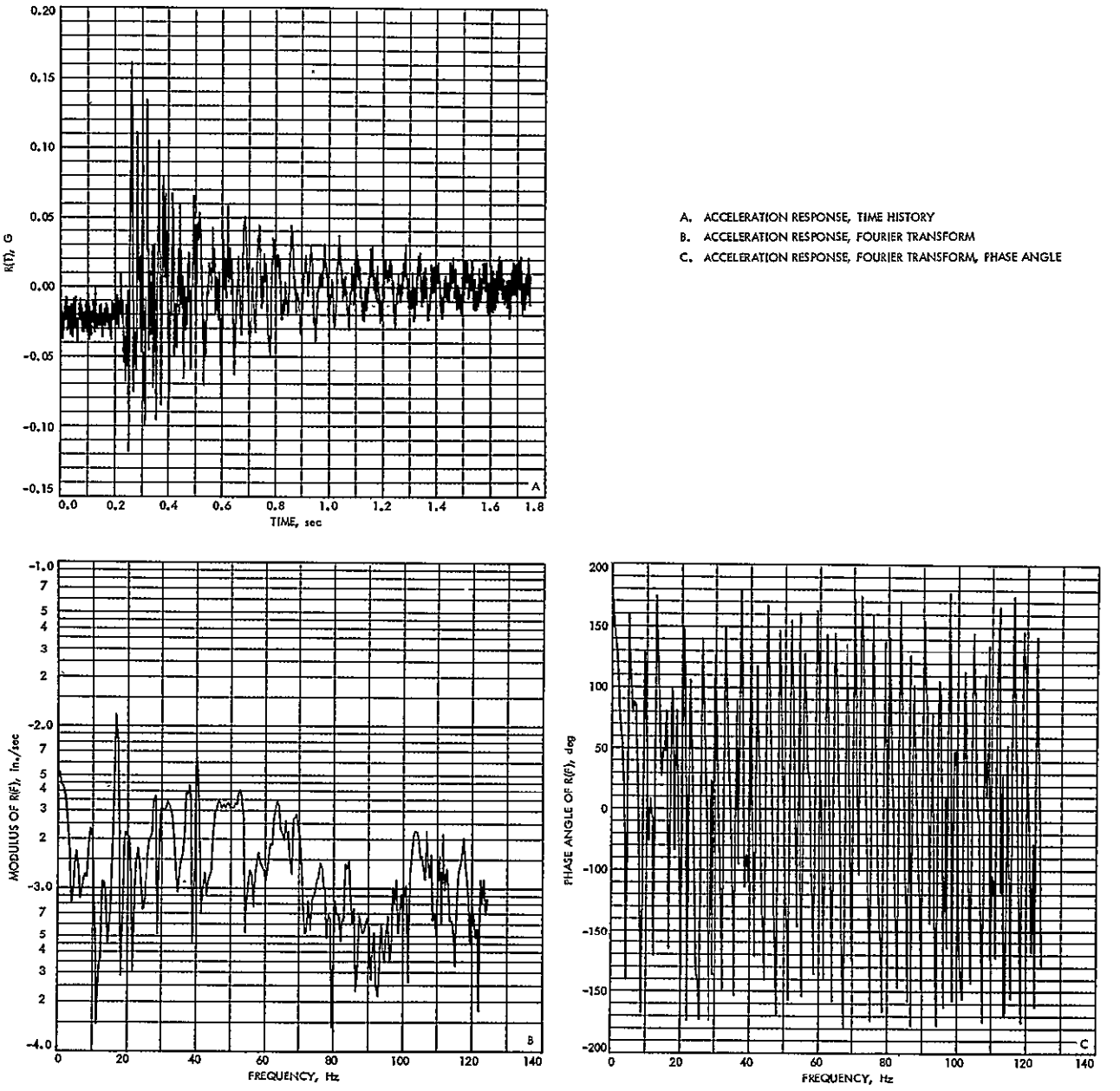

Fig. A1. Gridpoint 12, Acceleration response in X – Direction obtained from Mariner VII – Atlas/Centaur (AC-19) MECO flight data.

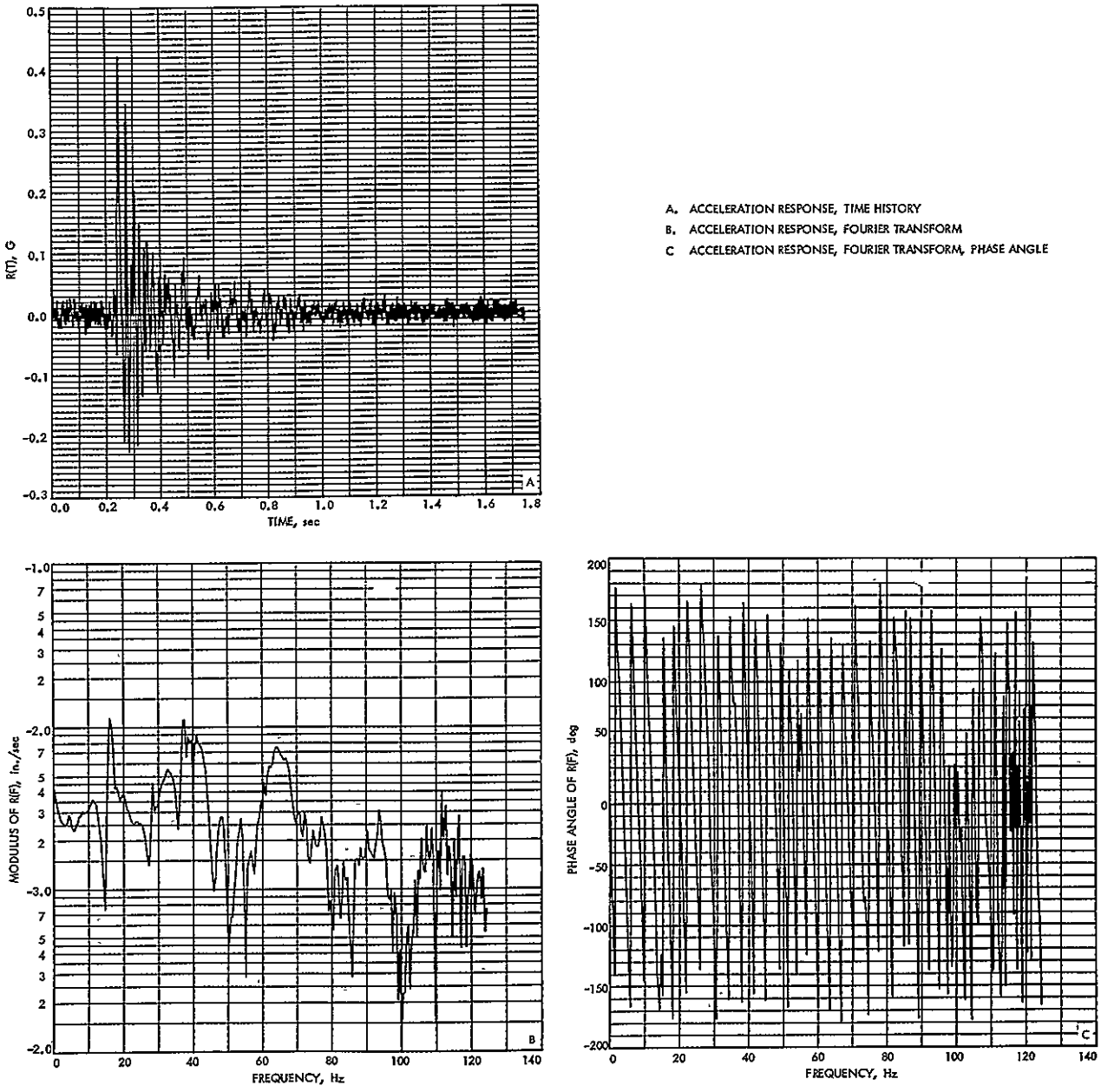

Fig. A2. Gridpoint 12, Acceleration response in Y – Direction obtained from Mariner VII – Atlas/Centaur (AC-19) MECO flight data.

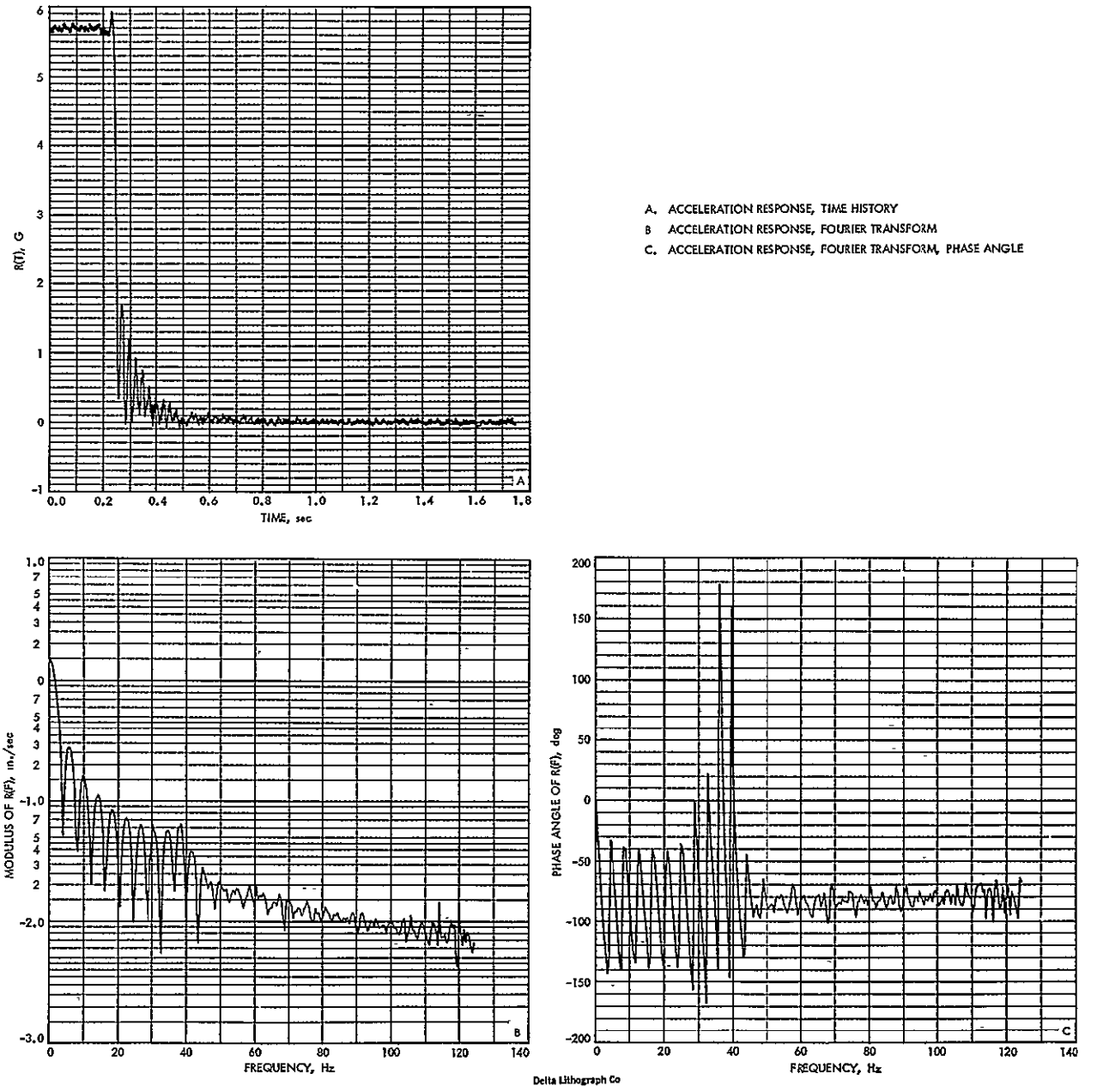

Fig. A3. Gridpoint 12, Acceleration response in Z – Direction obtained from Mariner VII – Atlas/Centaur (AC-19) MECO flight data.

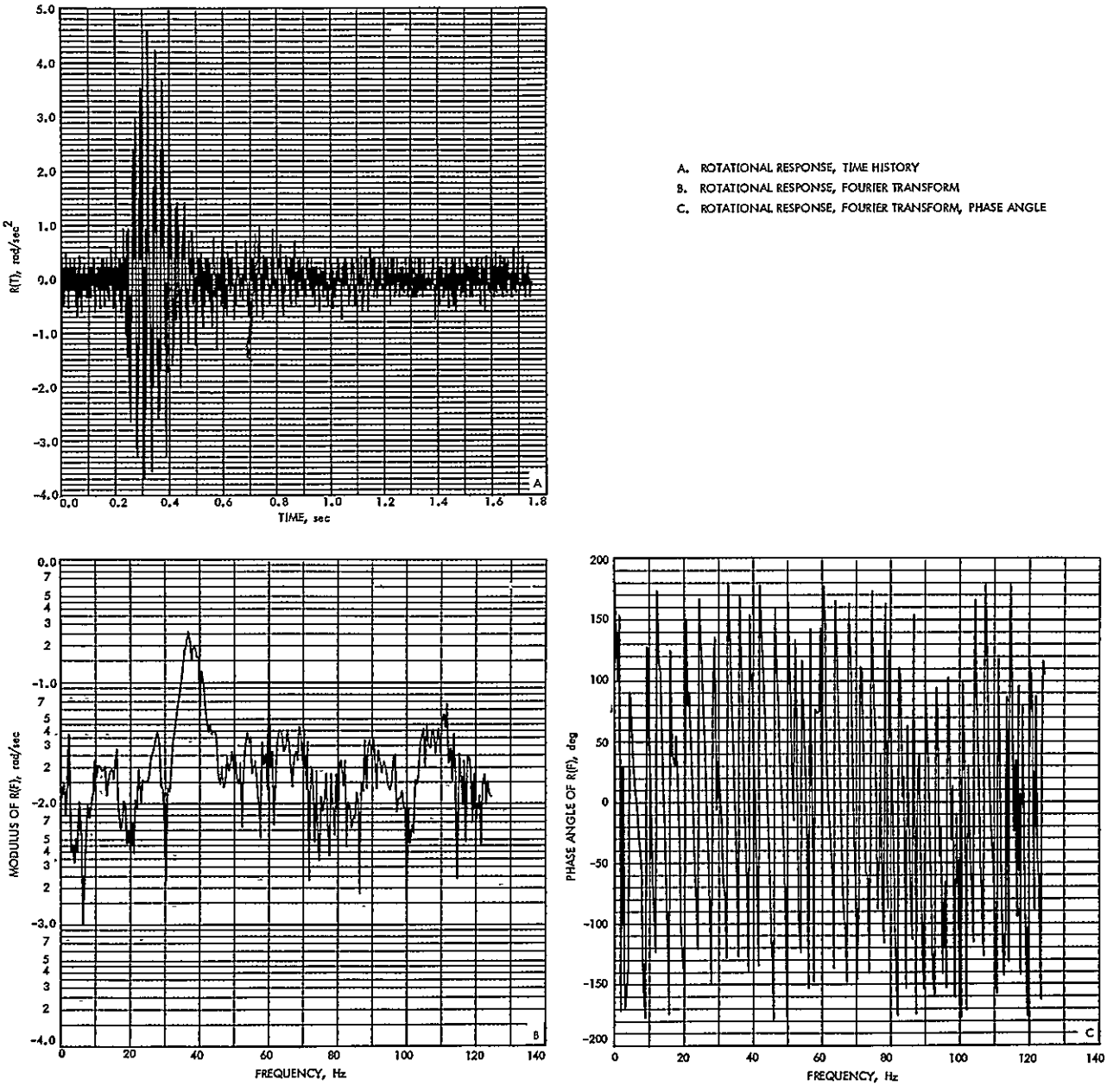

Fig. A4. Gridpoint 12, Rotational response in θ_X — Direction obtained from Mariner VII — Atlas/Centaur (AC-19) MECO flight data.

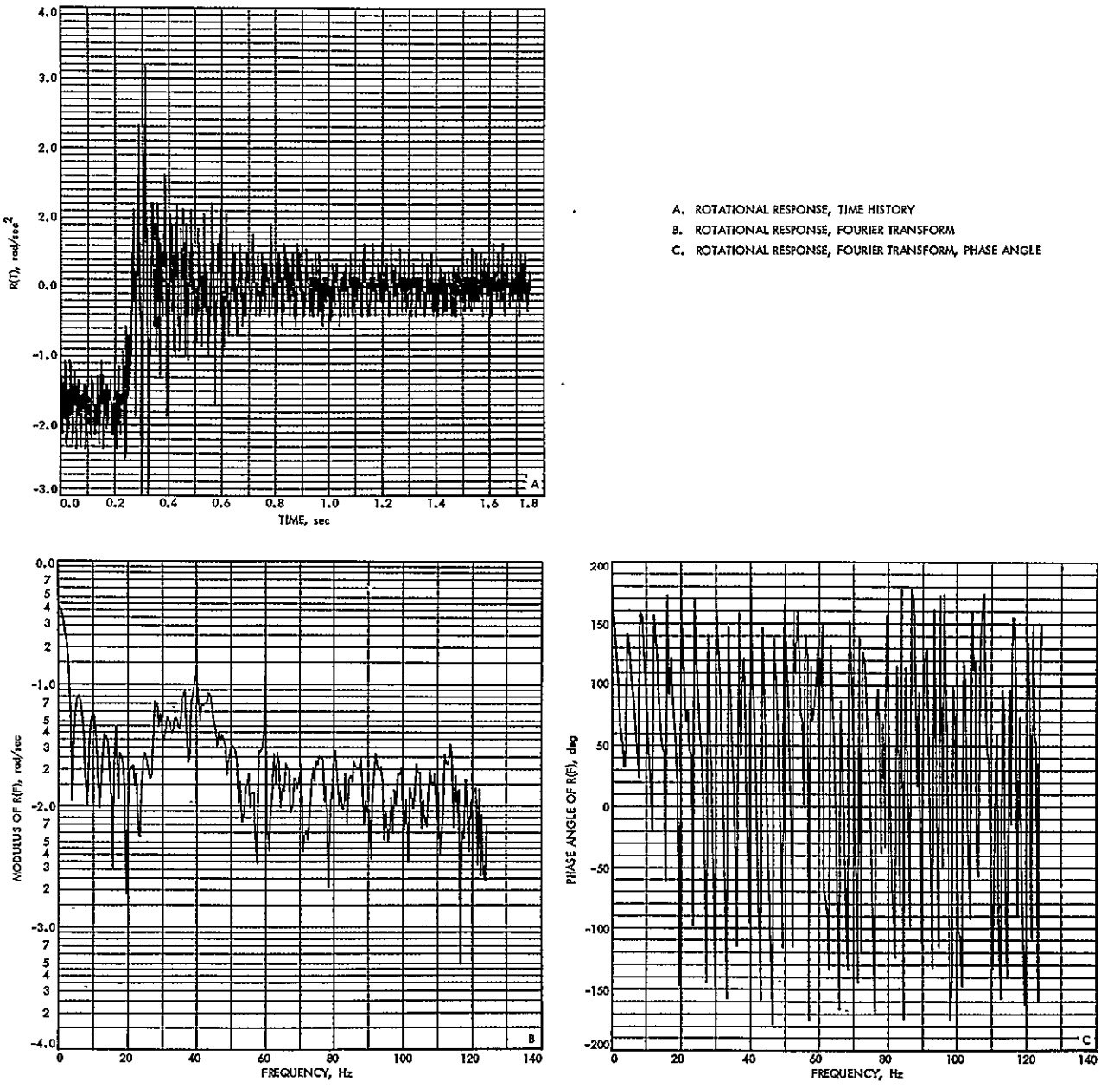

Fig. A5. Gridpoint 12, Rotational response in θ_V — Direction obtained from Mariner VII — Atlas/Centaur (AC-19) MECO flight data.

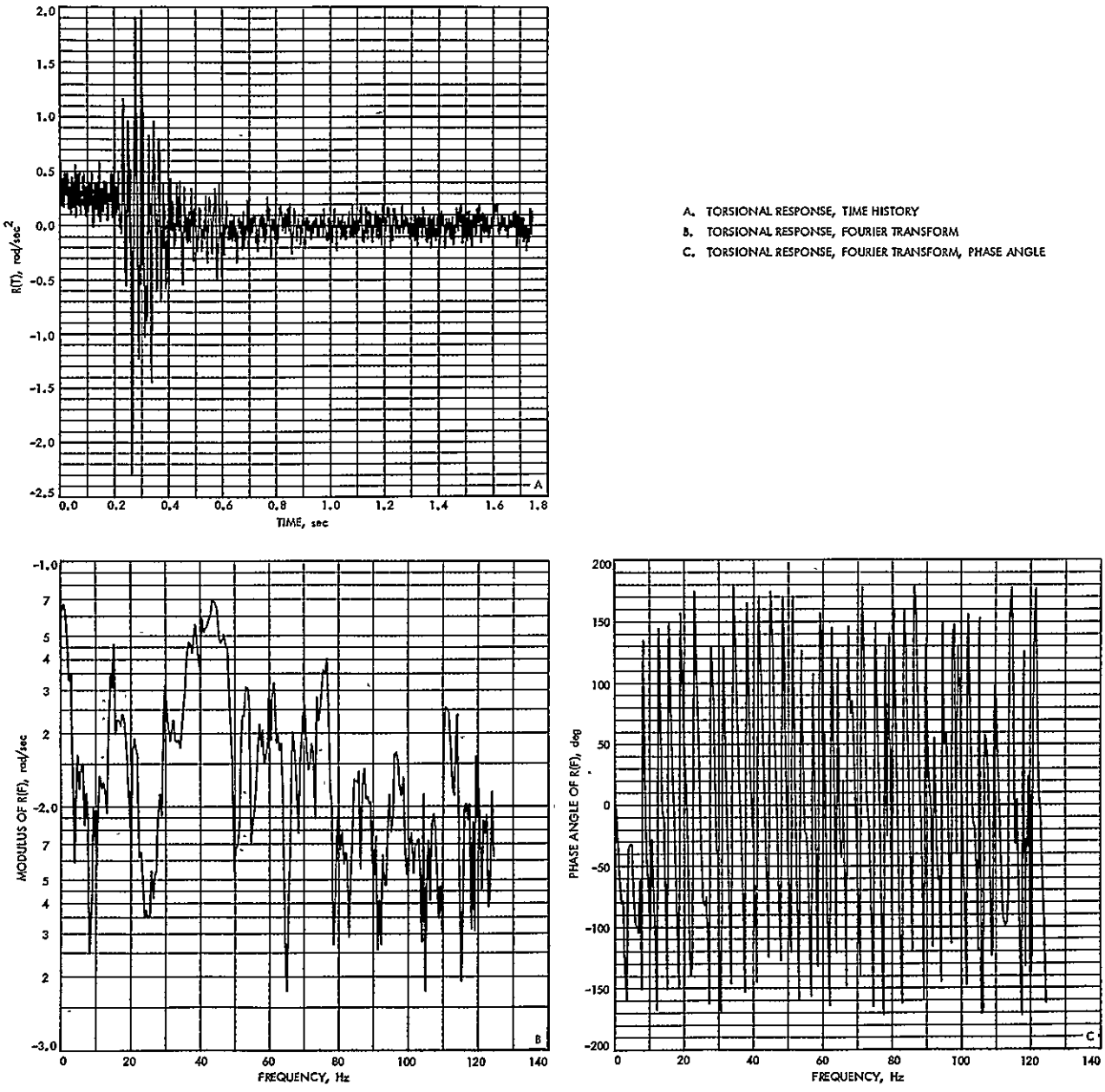

Fig. A6. Gridpoint 12, Torsional response in θ_Z – Direction obtained from Mariner VII – Atlas/Centaur (AC-19) MECO flight data.

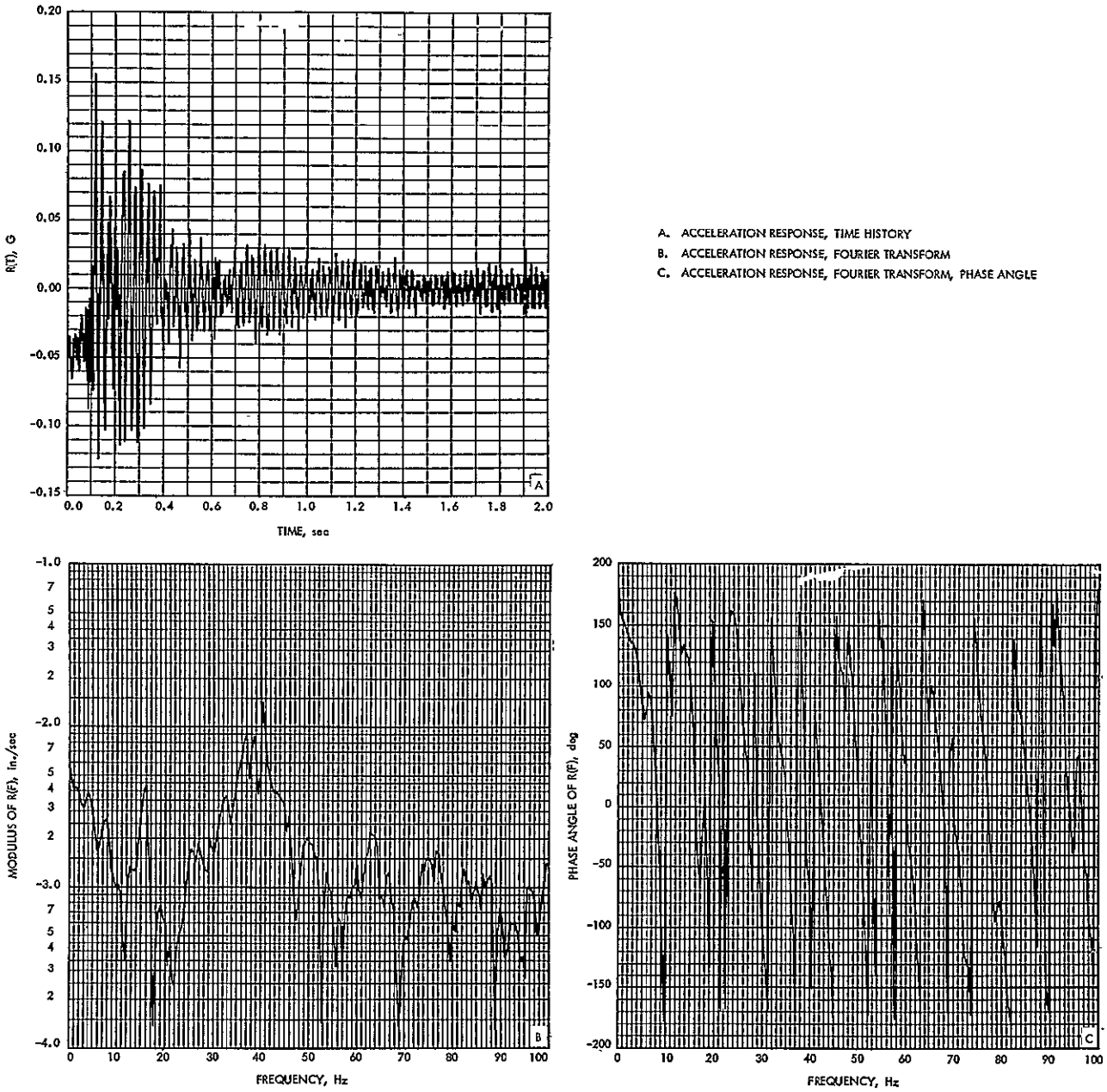

Fig. A7. Gridpoint 12, Acceleration response in X-direction at top of adapter obtained from Mariner VI--Atlas/Centaur (AC-20) MECO flight data

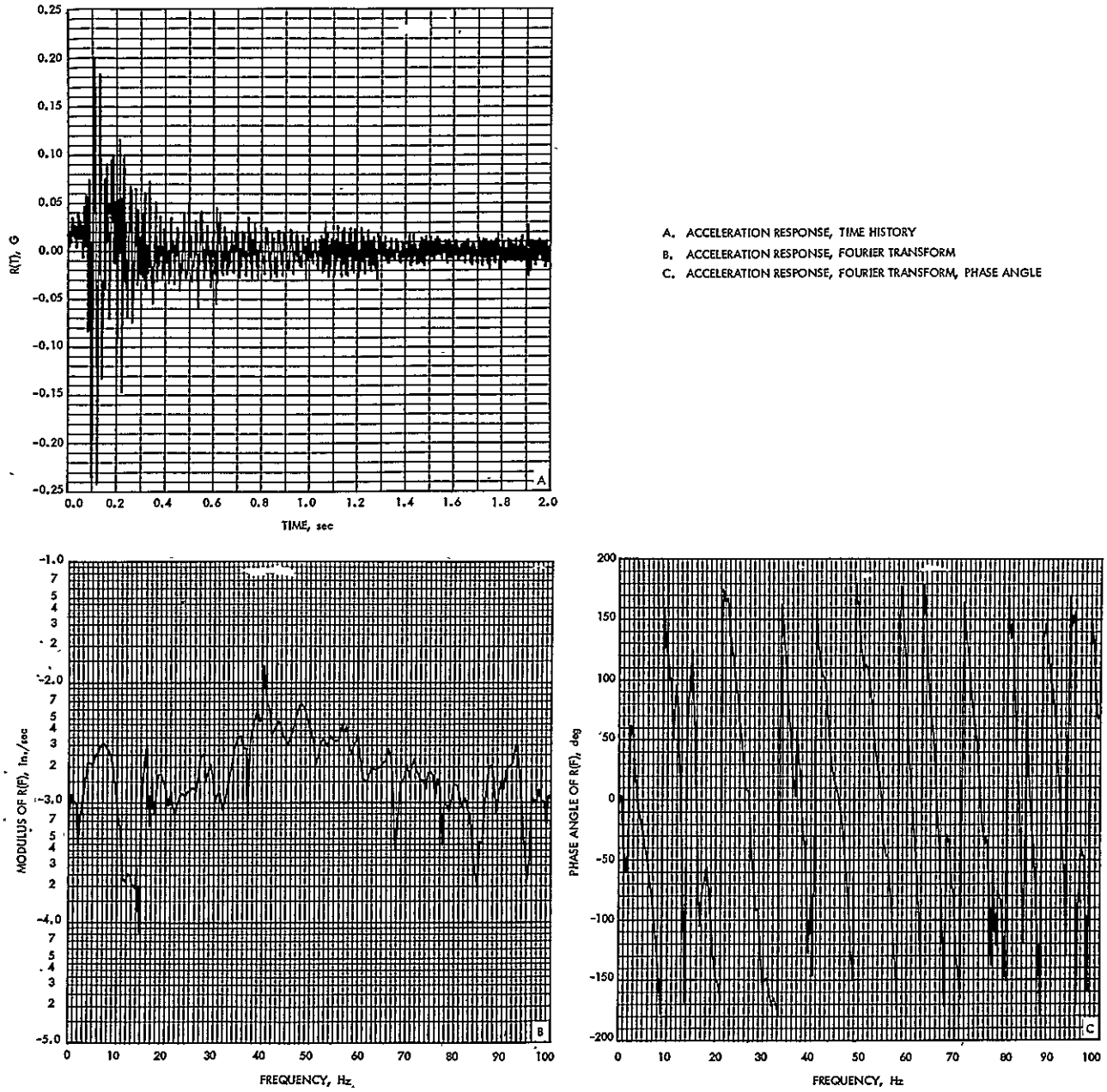

Fig. A8. Gridpoint 12, Acceleration response in Y-direction at top of adapter obtained from Mariner VI--Atlas/Centaur (AC-20) MECO flight data

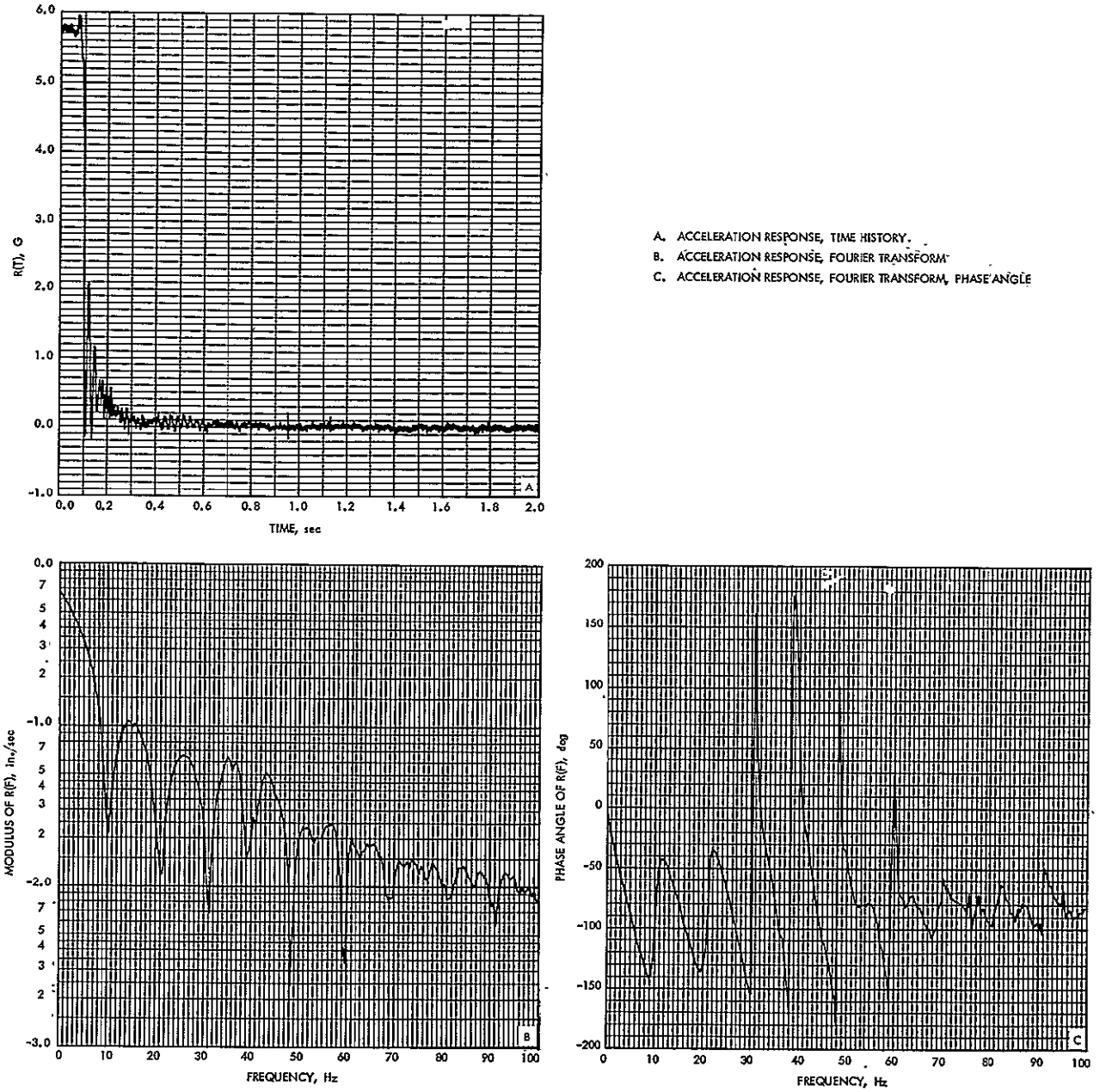

Fig. A9. Gridpoint 12, Acceleration response in Z-direction at top of adapter obtained from Mariner VI--Atlas/Centaur (AC-20) MECO flight data

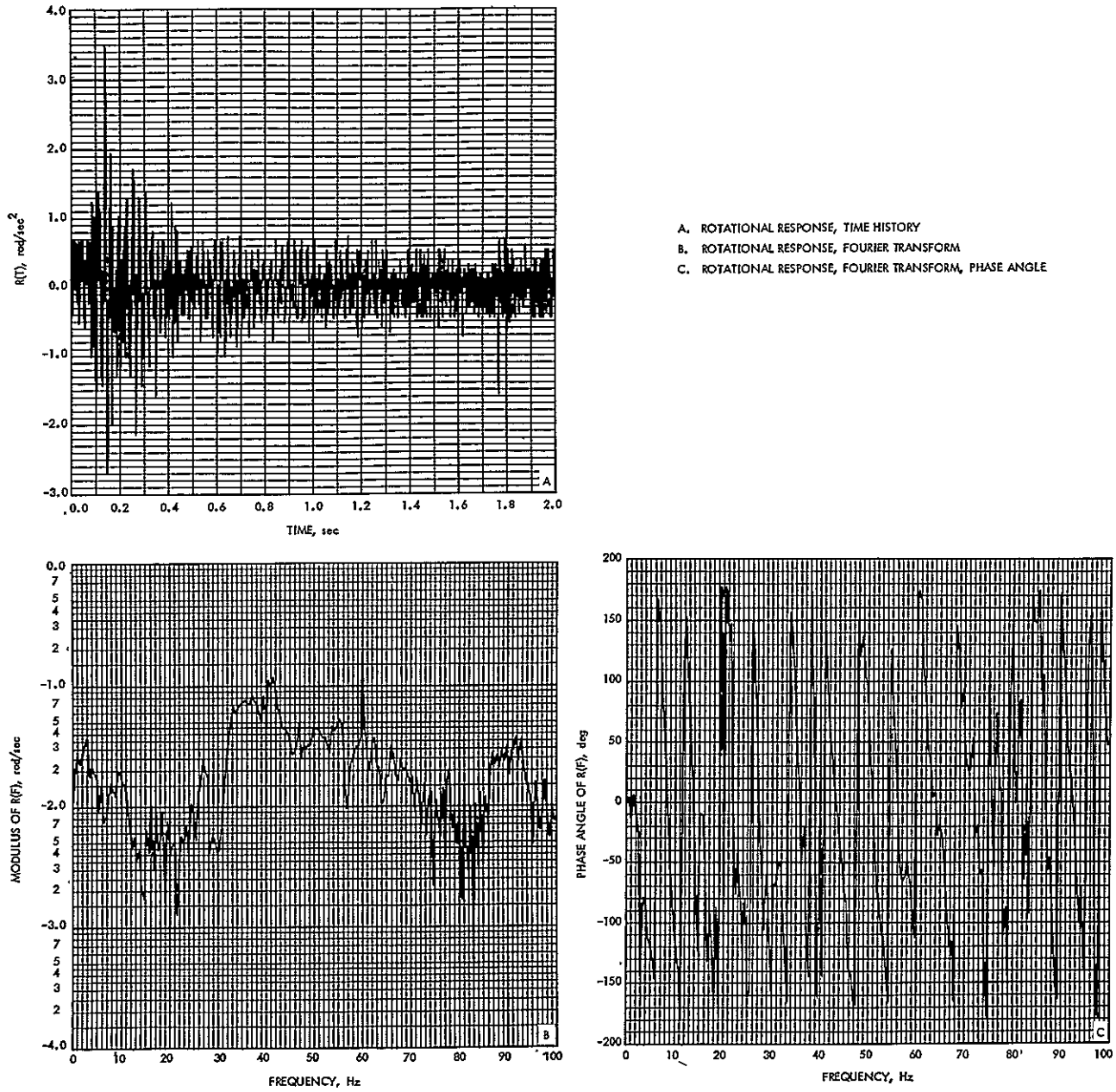

Fig. A10. Gridpoint 12, Rotational response in θ_X-direction at top of adapter obtained from Mariner VI--Atlas/Centaur (AC-20) MECO flight data

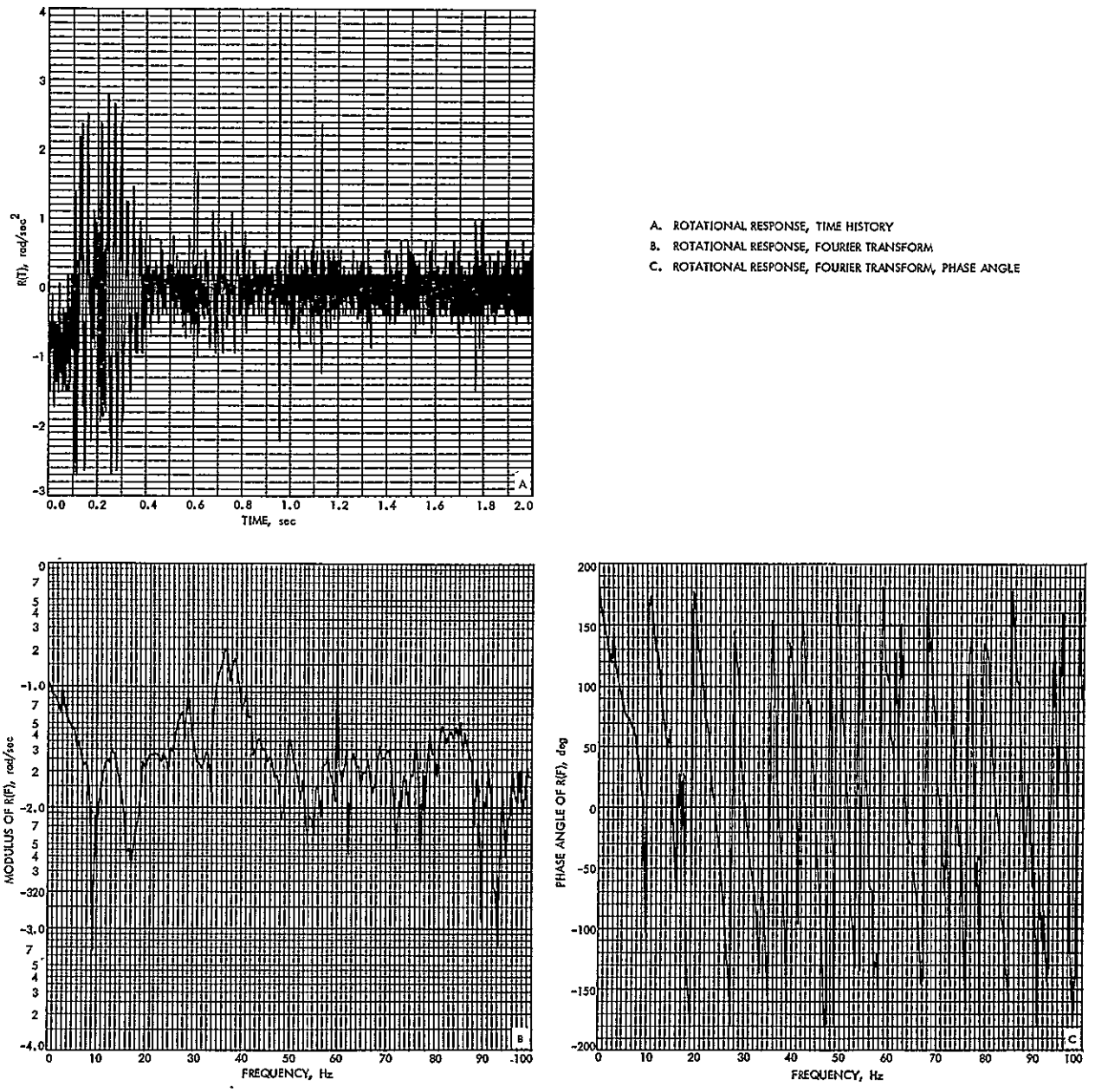

Fig. A11. Gridpoint 12, Rotational response in θ_y-direction at top of adapter obtained from Mariner VI--Atlas/Centaur (AC-20) MECO flight data

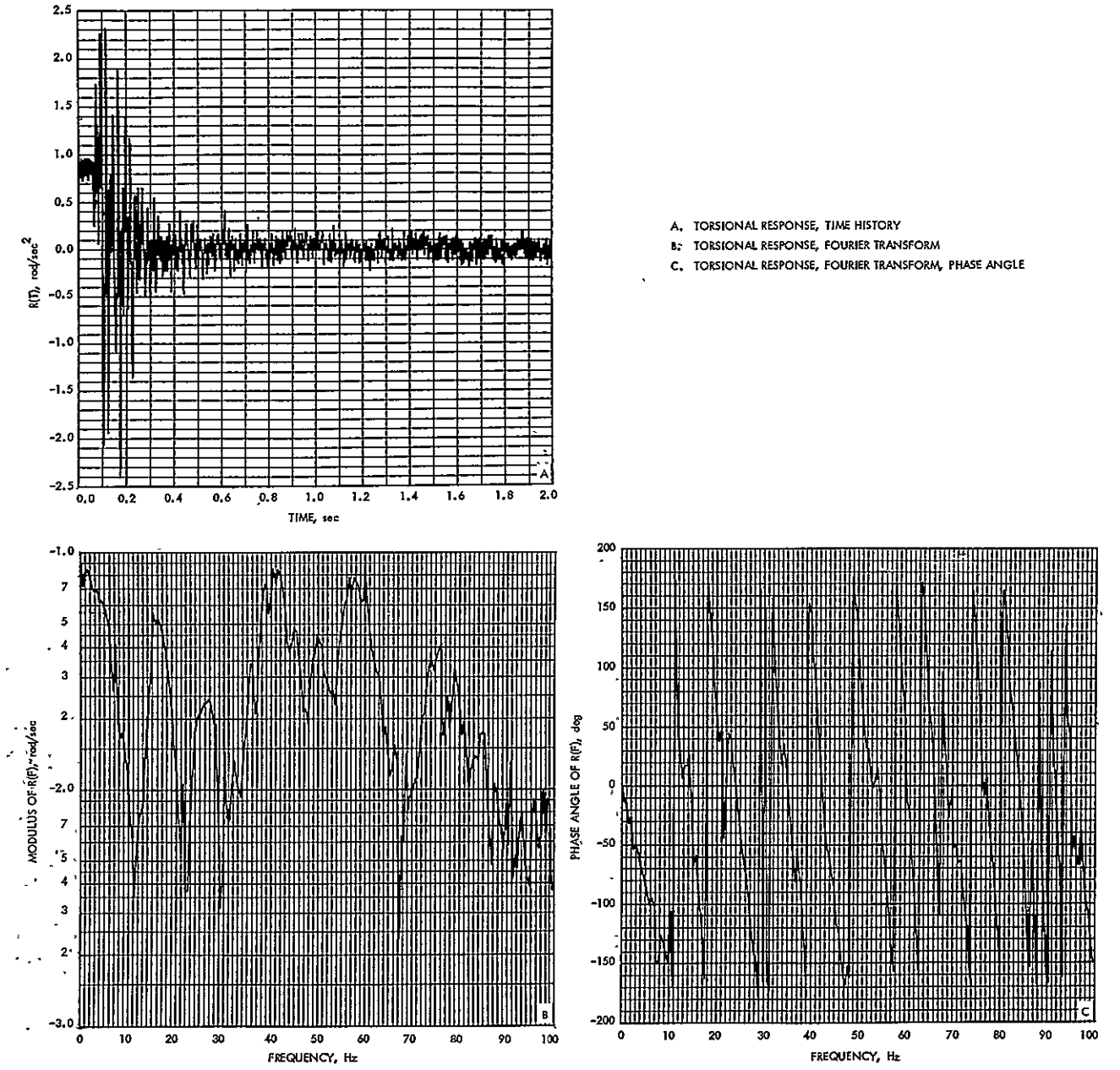

Fig. A12. Gridpoint 12, Torsional response in θ_Z-direction at top of adapter obtained from Mariner VI--Atlas/Centaur (AC-20) MECO flight data

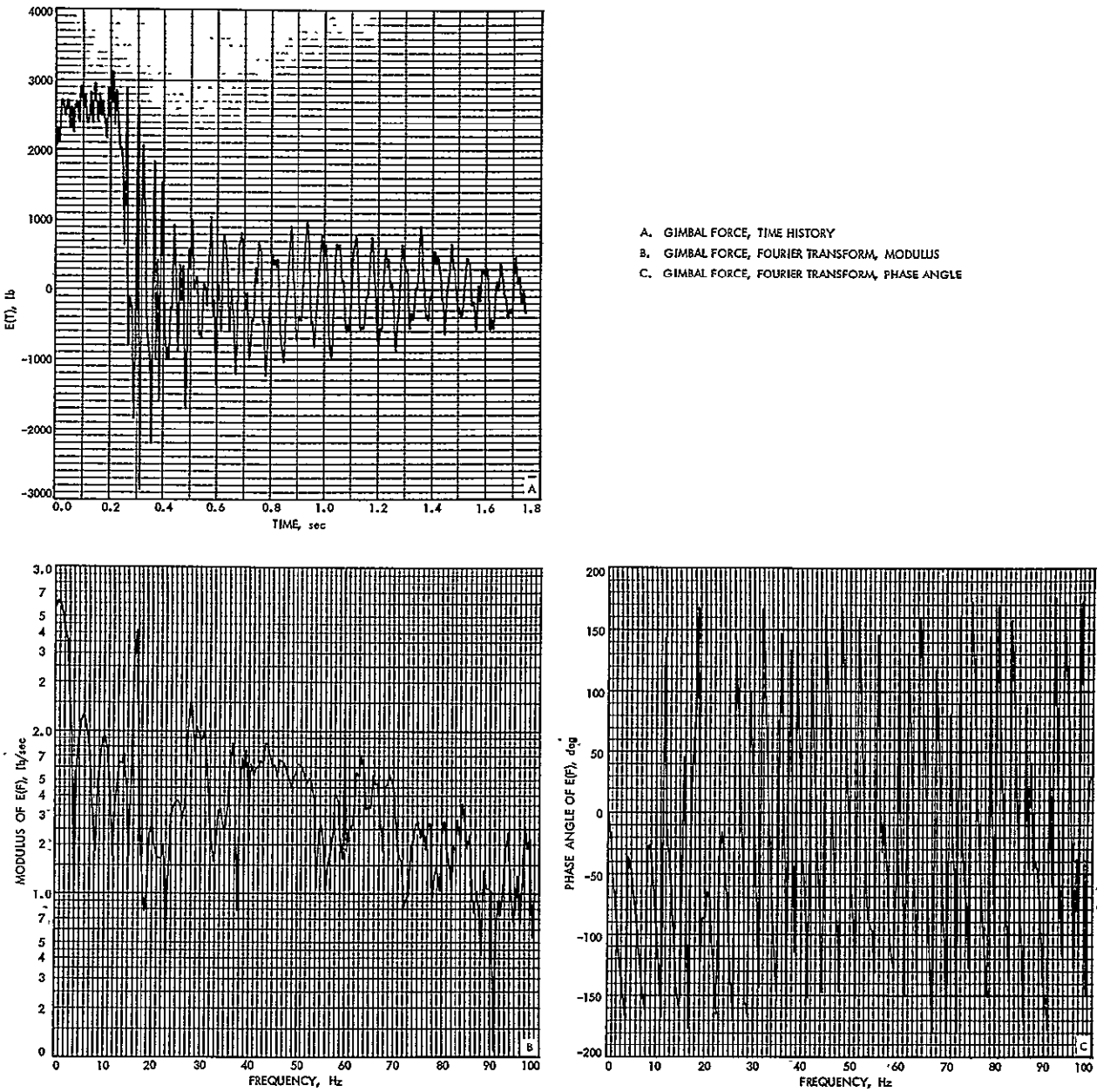

Fig. A13. Gridpoint 67, Centaur Gimbal Axis Forcing function in X – Direction derived from Mariner VII (AC-19) MECO flight data.

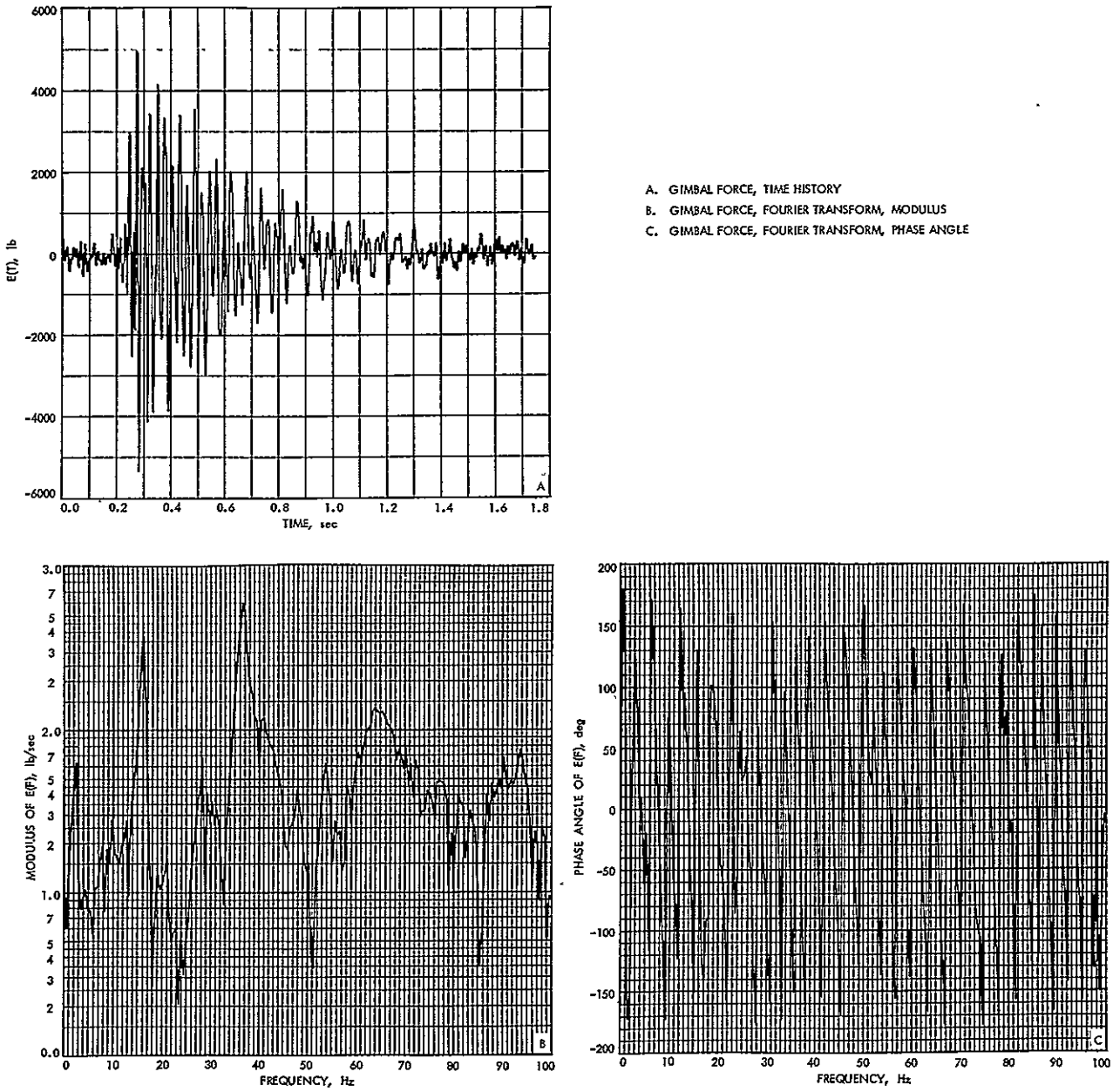

Fig. A14. Gridpoint 67, Centaur Gimbal Axis Forcing function in Y – Direction derived from Mariner VII (AC-19) MECO flight data.

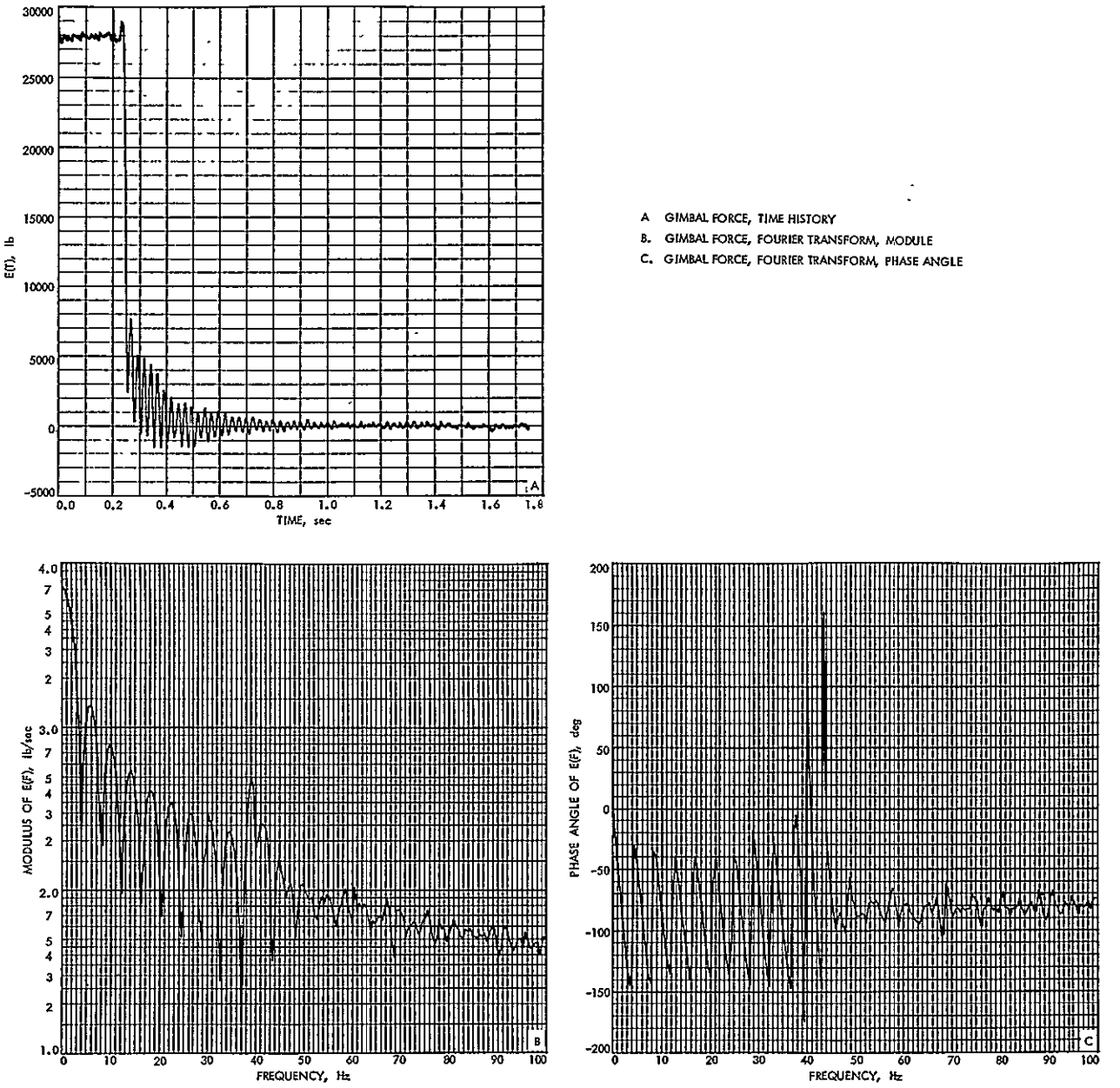

Fig. A15. Gridpoint 67, Centaur Gimbal Axis Forcing function in Z – Direction derived from Mariner VII (AC-19) MECO flight data.

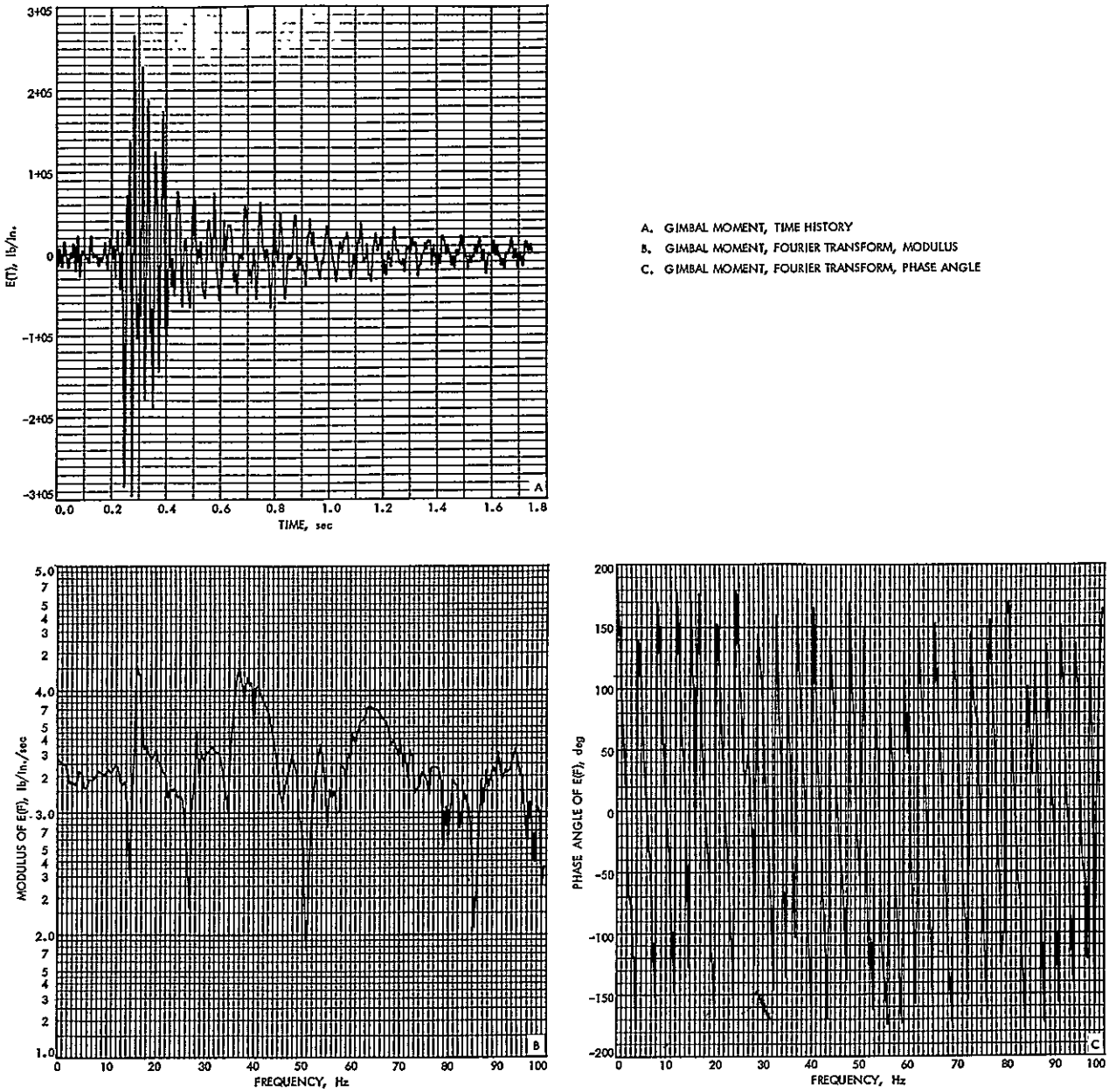

Fig. A16. Gridpoint 67, Centaur Gimbal Axis Moment function in θ_x – Direction derived from Mariner VII (AC-19) MECO flight data.

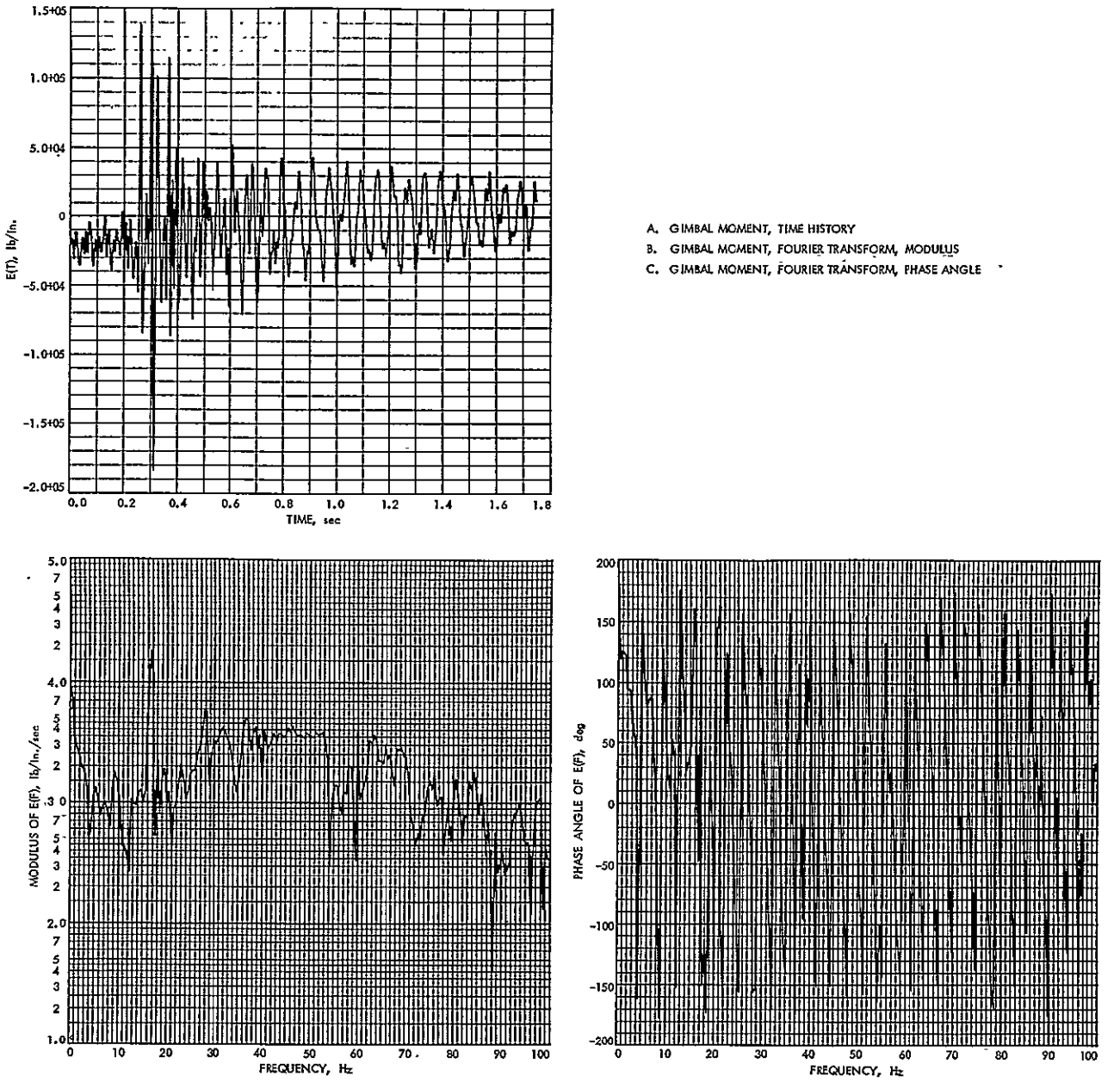

Fig. A17. Gridpoint 67, Centaur Gimbal Axis Moment function in θ_y — Direction derived from Mariner VII (AC-19) MECO flight data.

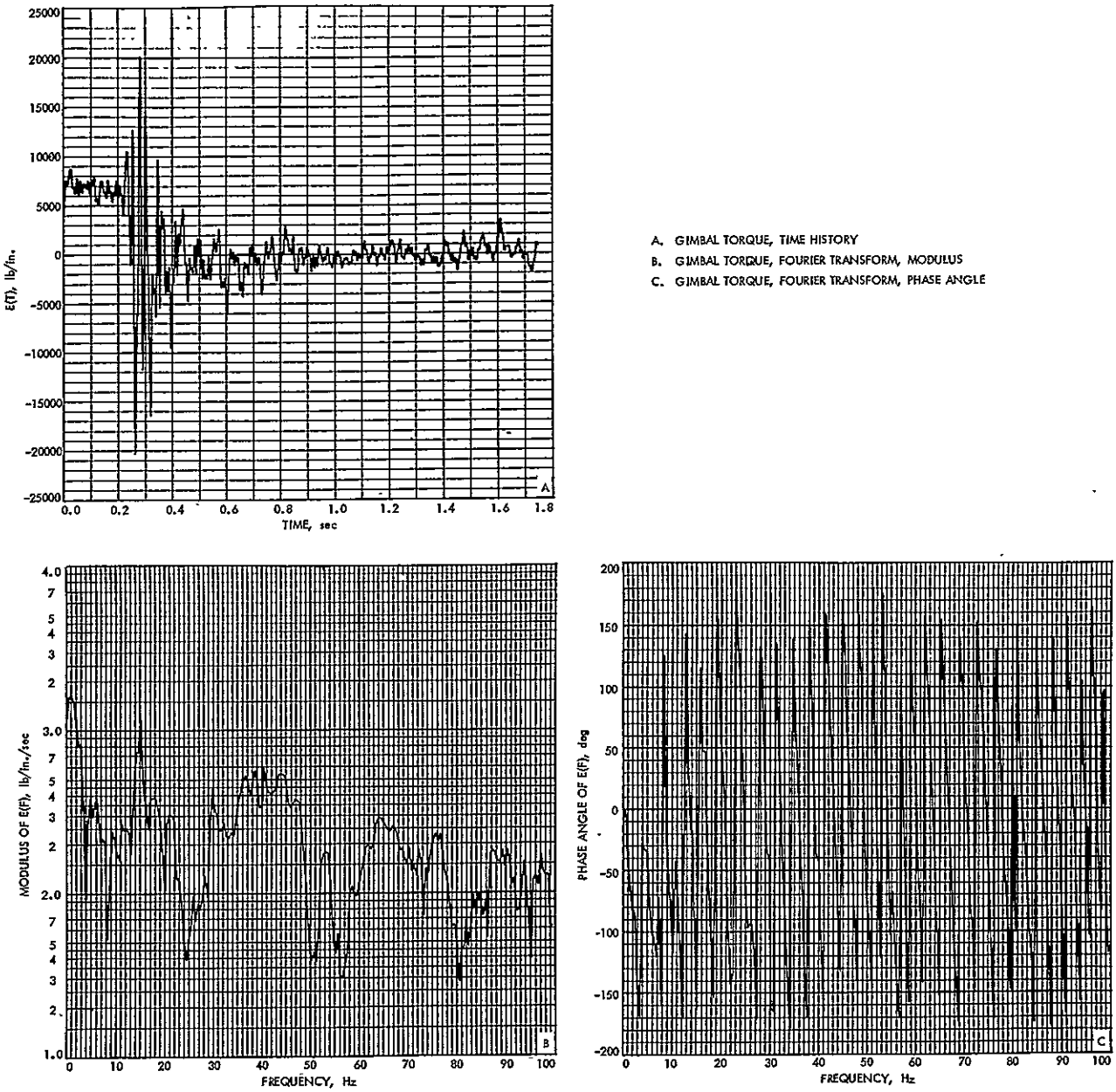

Fig. A18. Gridpoint 67, Centaur Gimbal Axis Torque function in θ_z – Direction derived from Mariner VII (AC-19) MECO flight data.

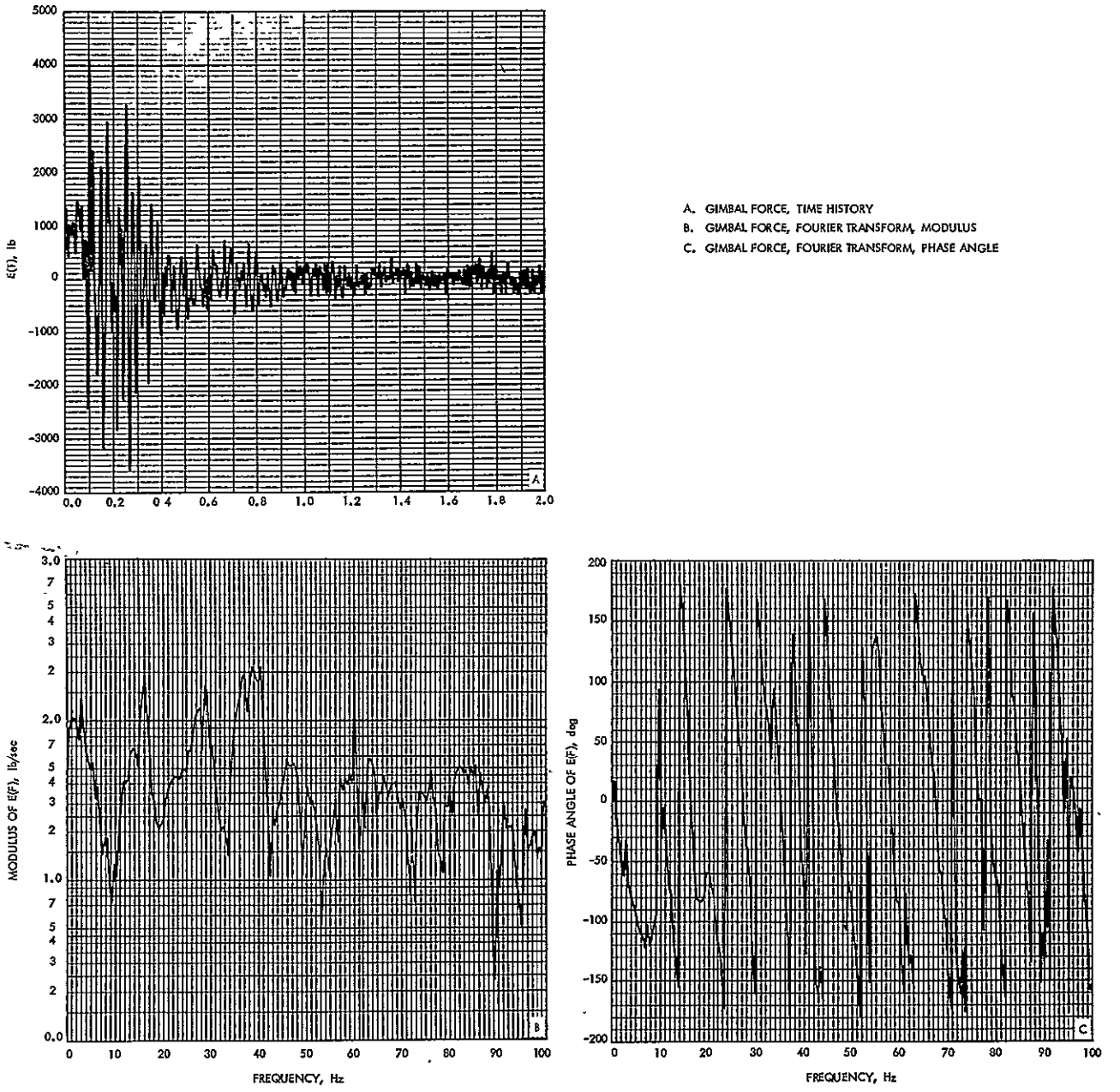

Fig. A19. Gridpoint 67, Centaur Gimbal Axis Forcing function in X - Direction Derived from Mariner VI (AC-20) MECO flight data.

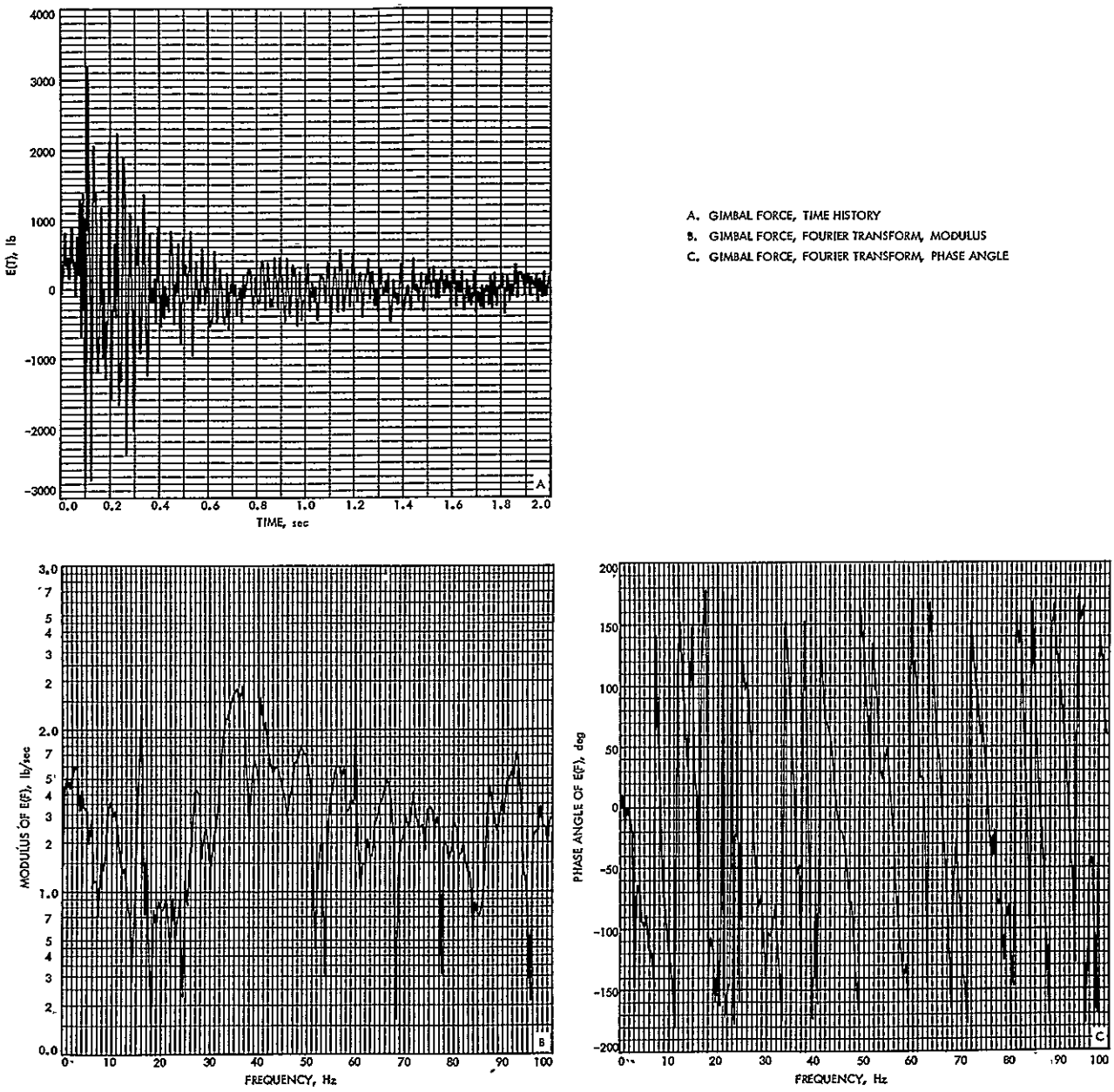

Fig. A20. Gridpoint 67, Centaur Gimbal Axis Forcing function in Y - Direction Derived from Mariner VI (AC-20) MECO flight data.

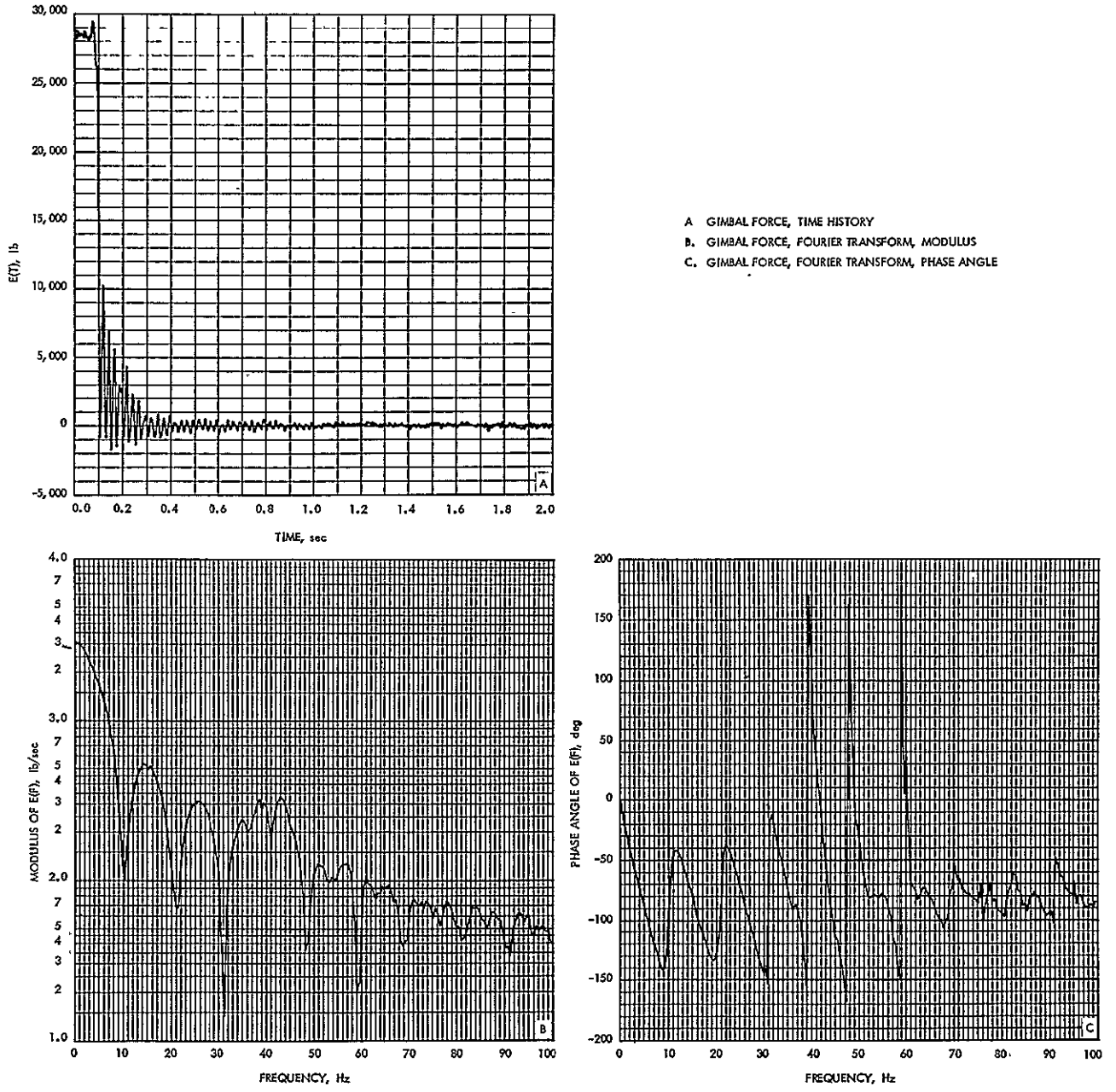

Fig. A21. Gridpoint 67, Centaur Gimbal Axis Forcing function in Z - Direction Derived from Mariner VI (AC-20) MECO flight data.

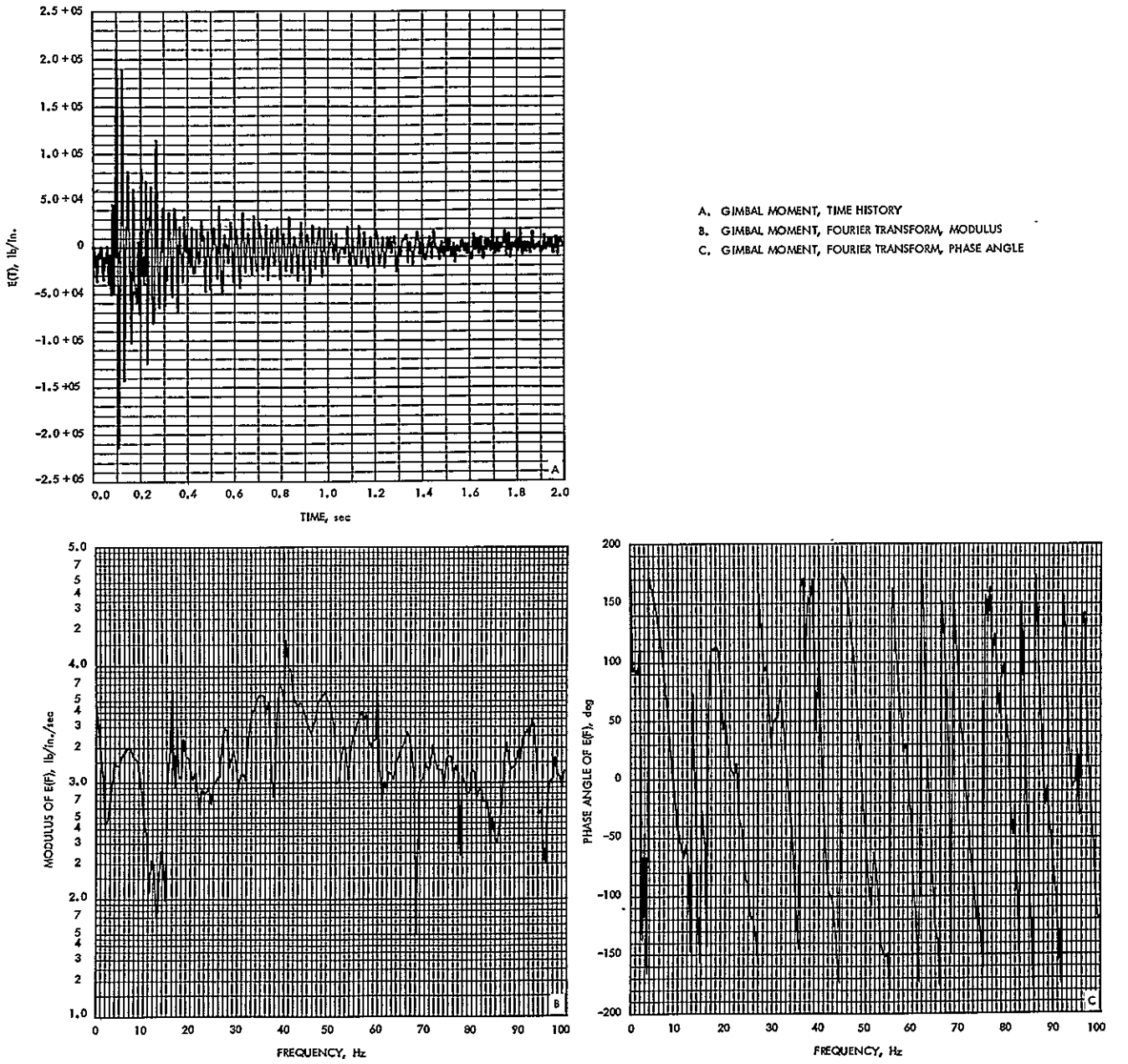

Fig. A22. Gridpoint 67, Centaur Gimbal Axis Moment function in θ_x - Direction Derived from Mariner VI (AC-20) MECO flight data.

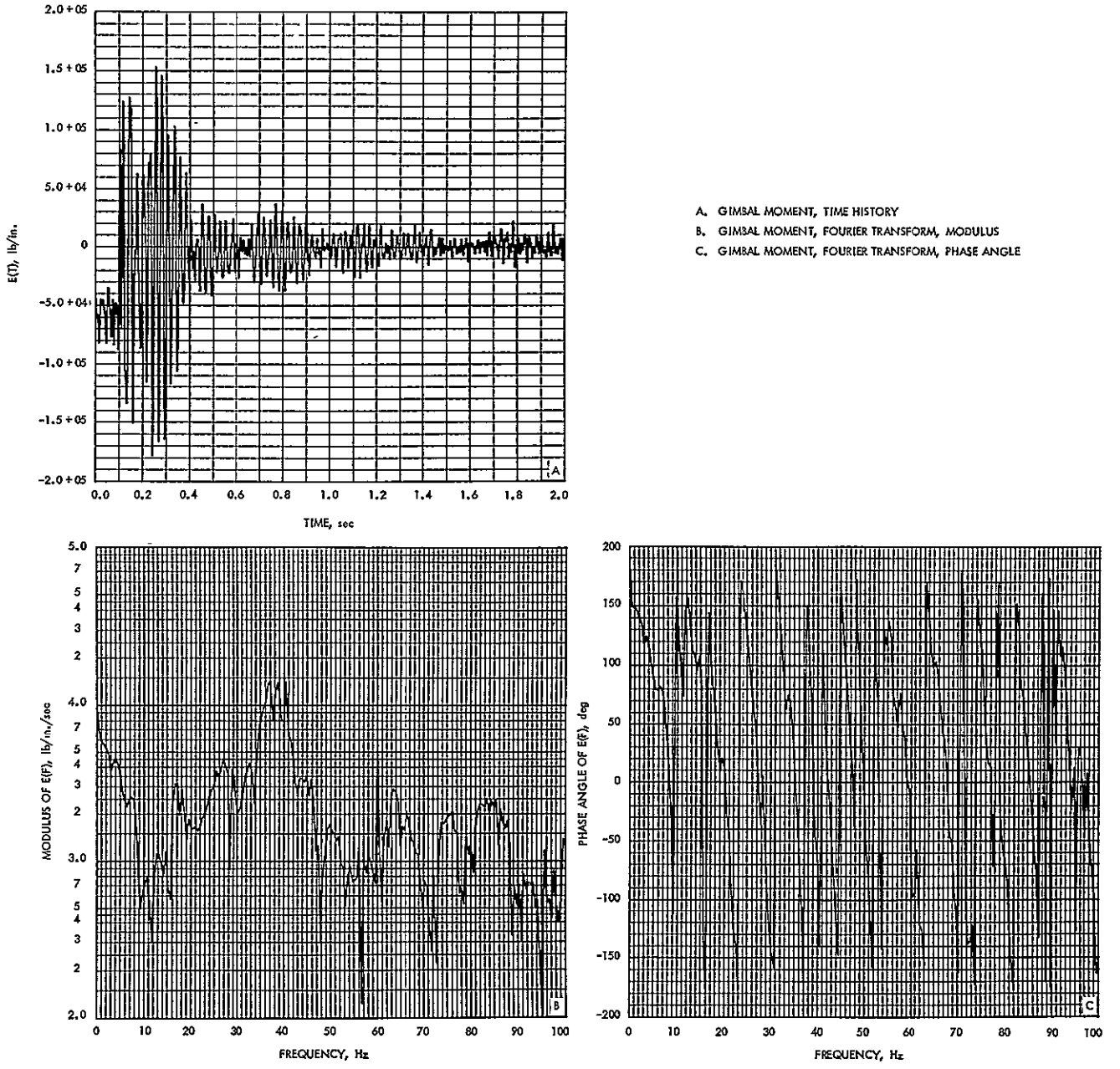

Fig. A23. Gridpoint 67, Centaur Gimbal Axis Moment function in θ_y - Direction Derived from Mariner VI (AC-20) MECO flight data.

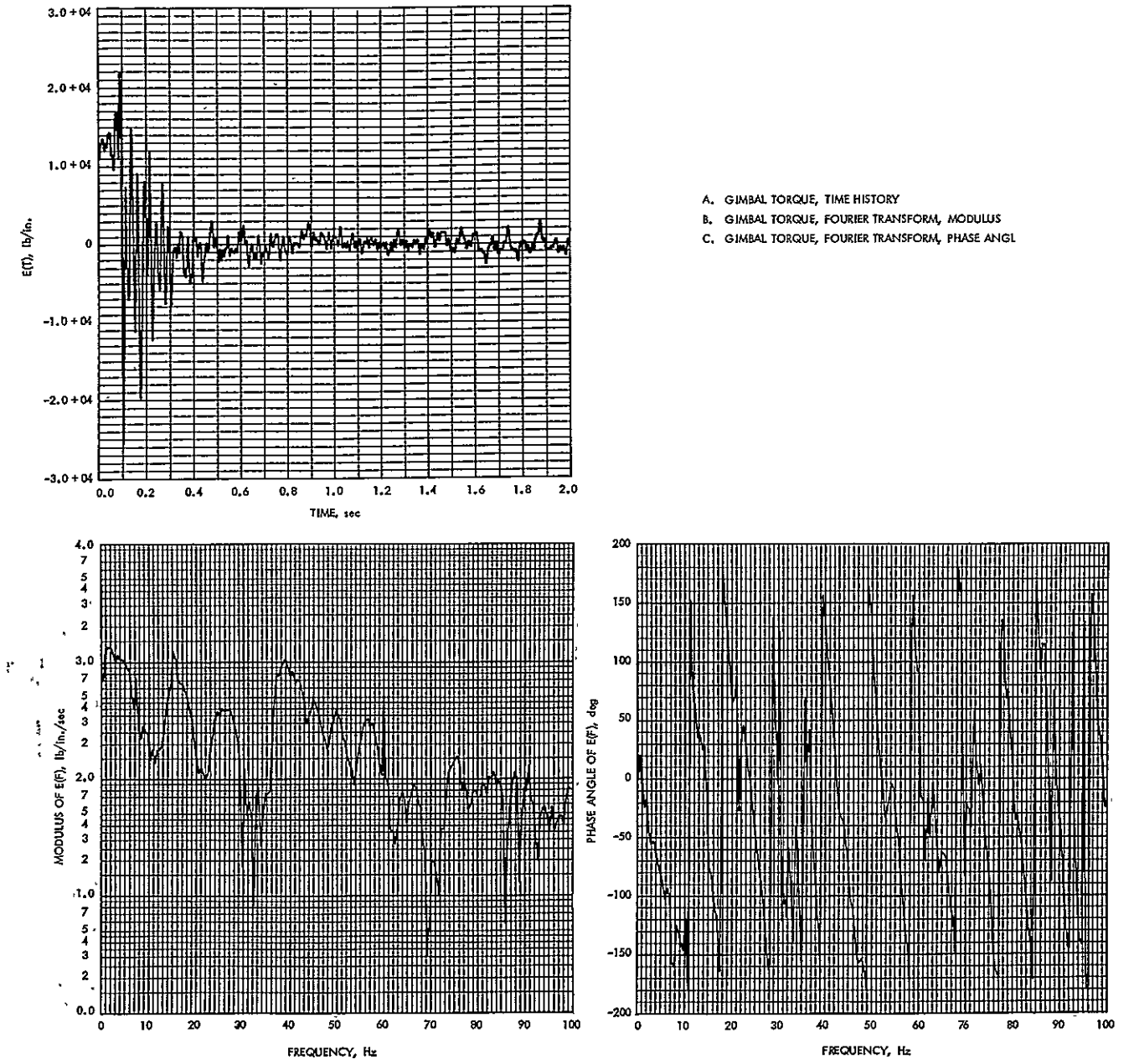

Fig. A24. Gridpoint 67, Centaur Gimbal Axis Torque function in θ_Z - Direction Derived from Mariner VI (AC-20) MECO flight data.

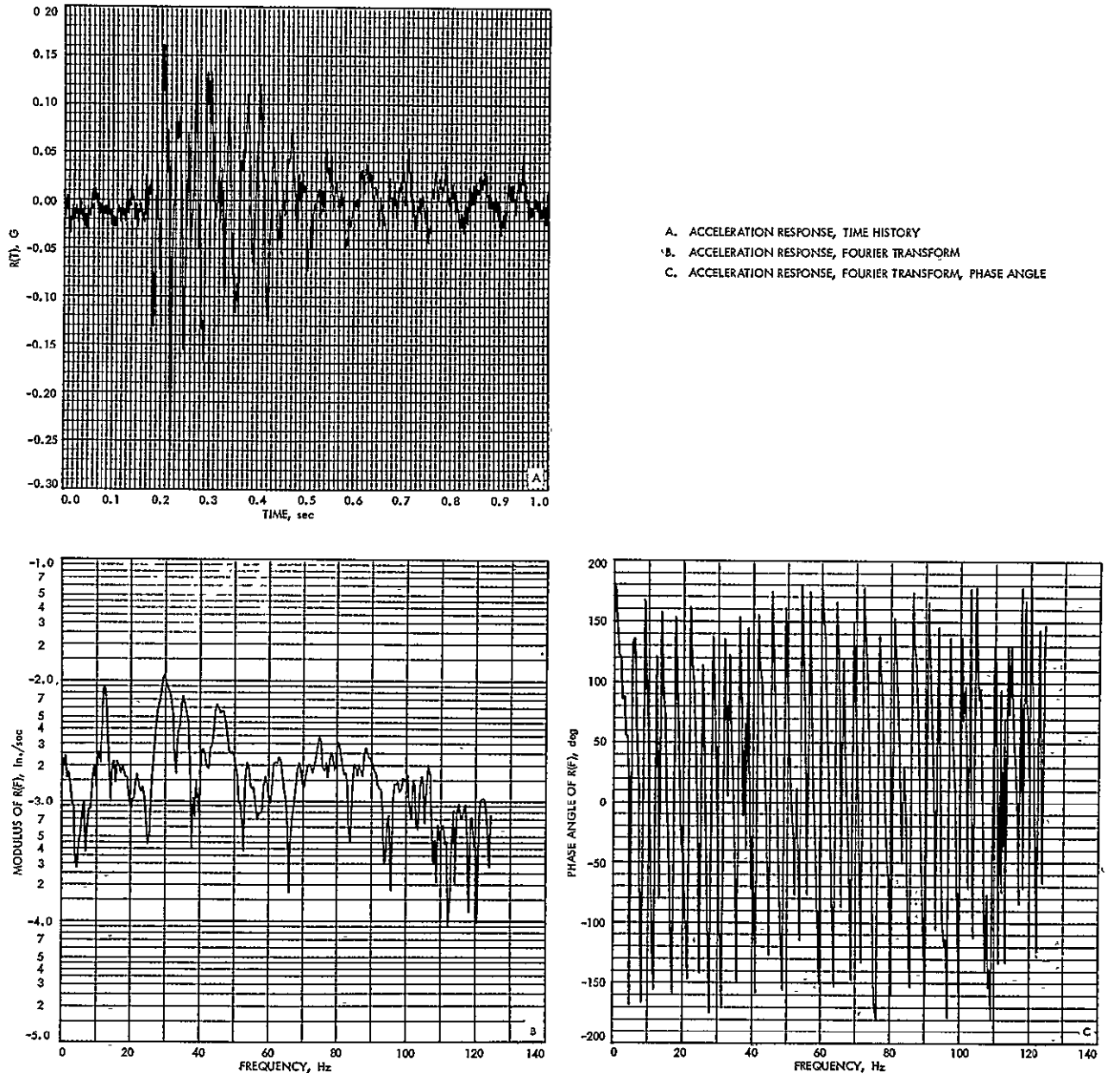

Fig. A25. Gridpoint 12, Acceleration response in X-direction at top of transition adapter obtained from the Orbiting Astronomical Observatory--Atlas/Centaur (AC-16) MECO flight data

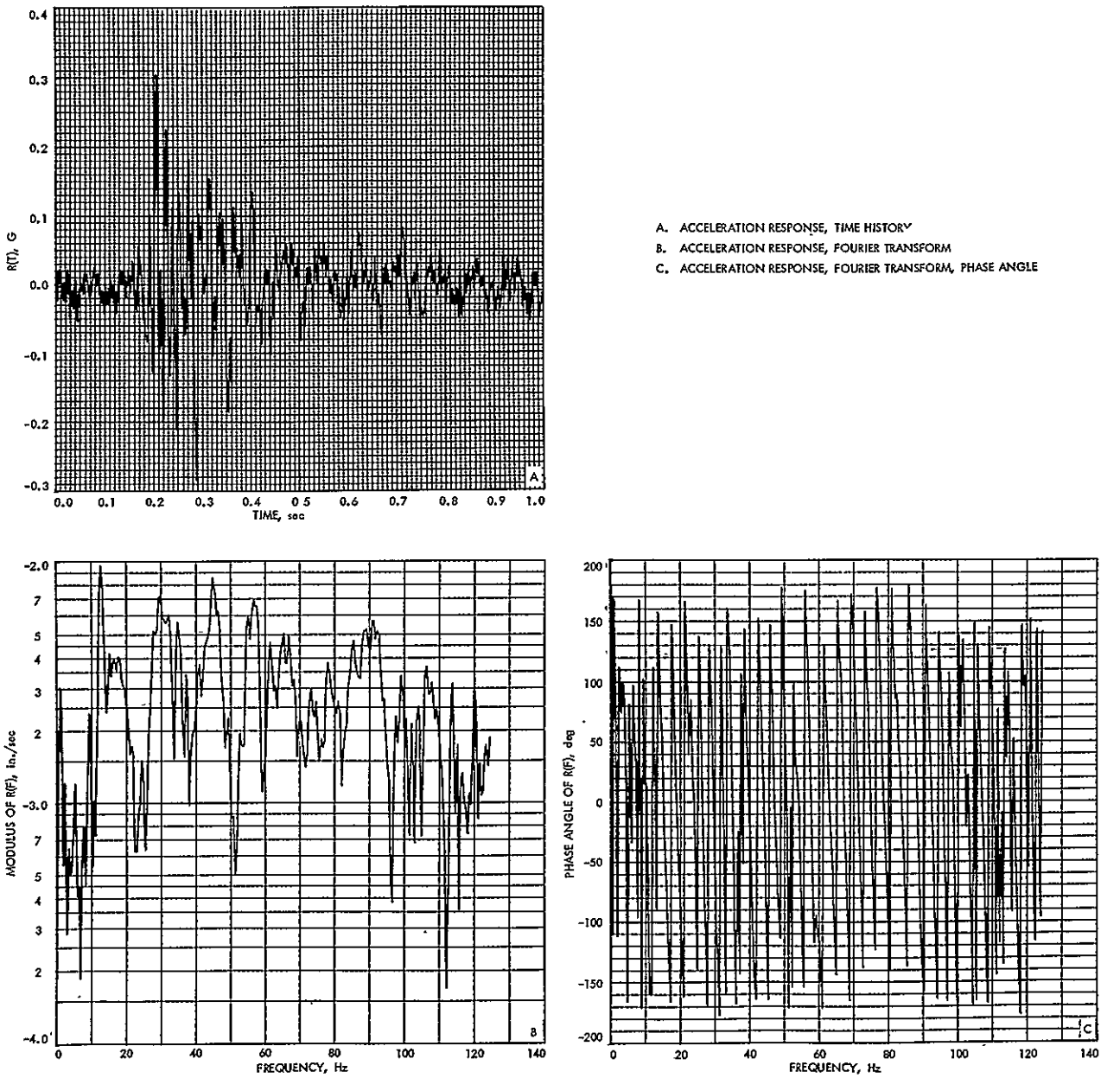

Fig. A26. Gridpoint 12, Acceleration response in Y-direction at top of transition adapter obtained from the Orbiting Astronomical Observatory--Atlas/Centaur (AC-16) MECO flight data

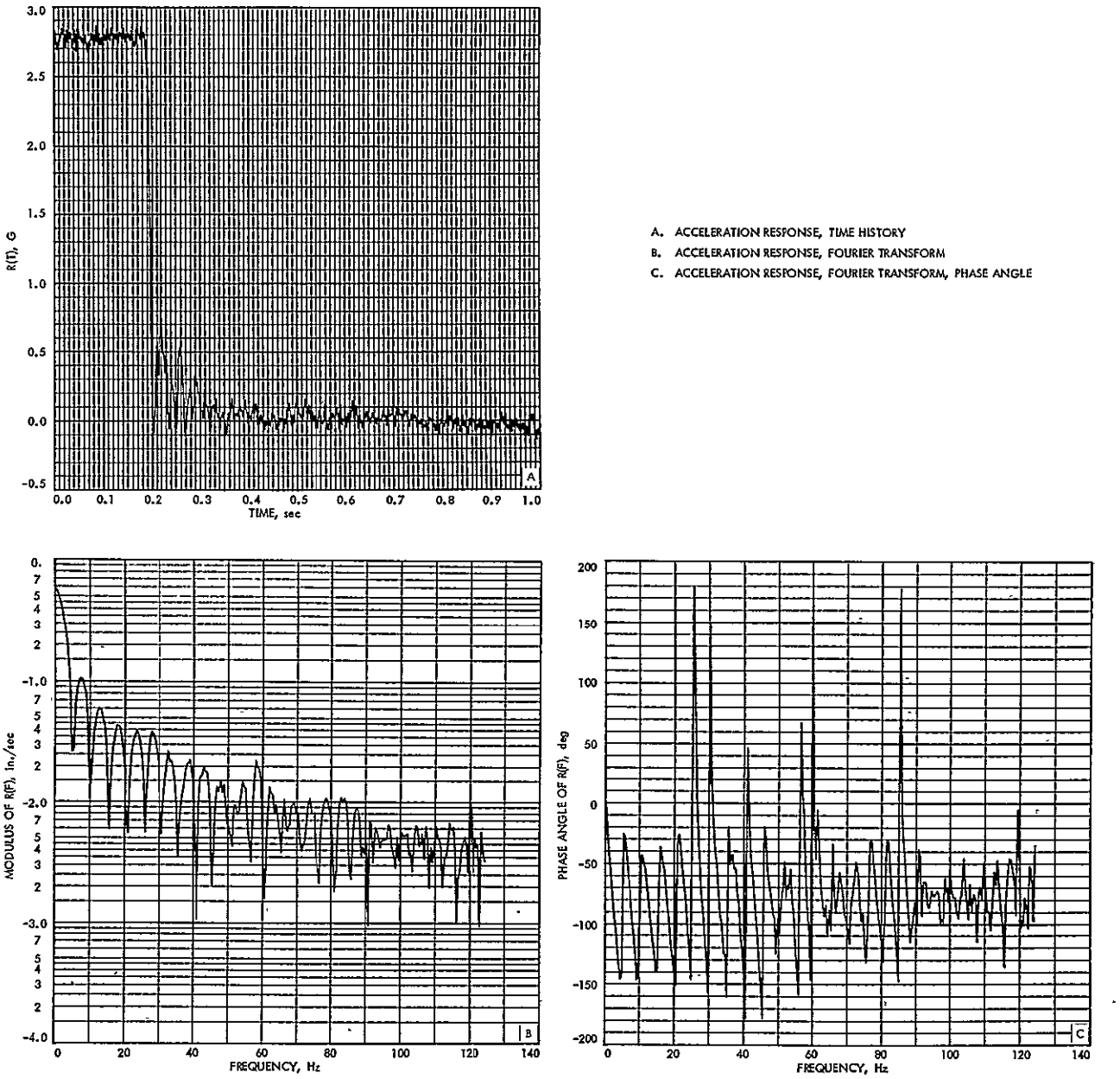

Fig. A27. Gridpoint 12, Acceleration response in Z-direction at top of transition adapter obtained from the Orbiting Astronomical Observatory--Atlas/Centaur (AC-16) MECO flight data

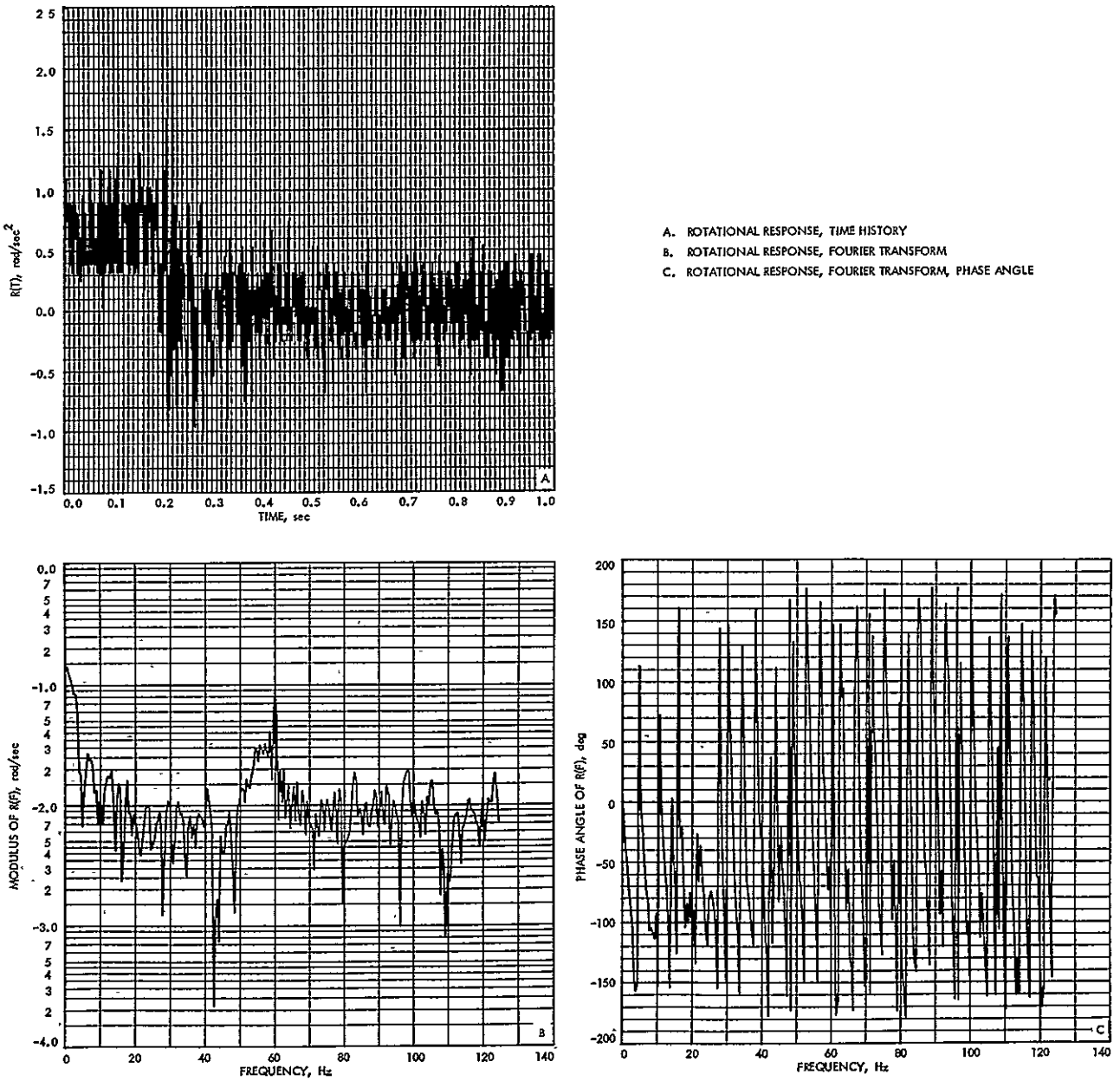

Fig. A28. Gridpoint 12, Rotational response in θ_x-direction at top of transition adapter obtained from the Orbiting Astronomical Observatory--Atlas/Centaur (AC-16) MECO flight data

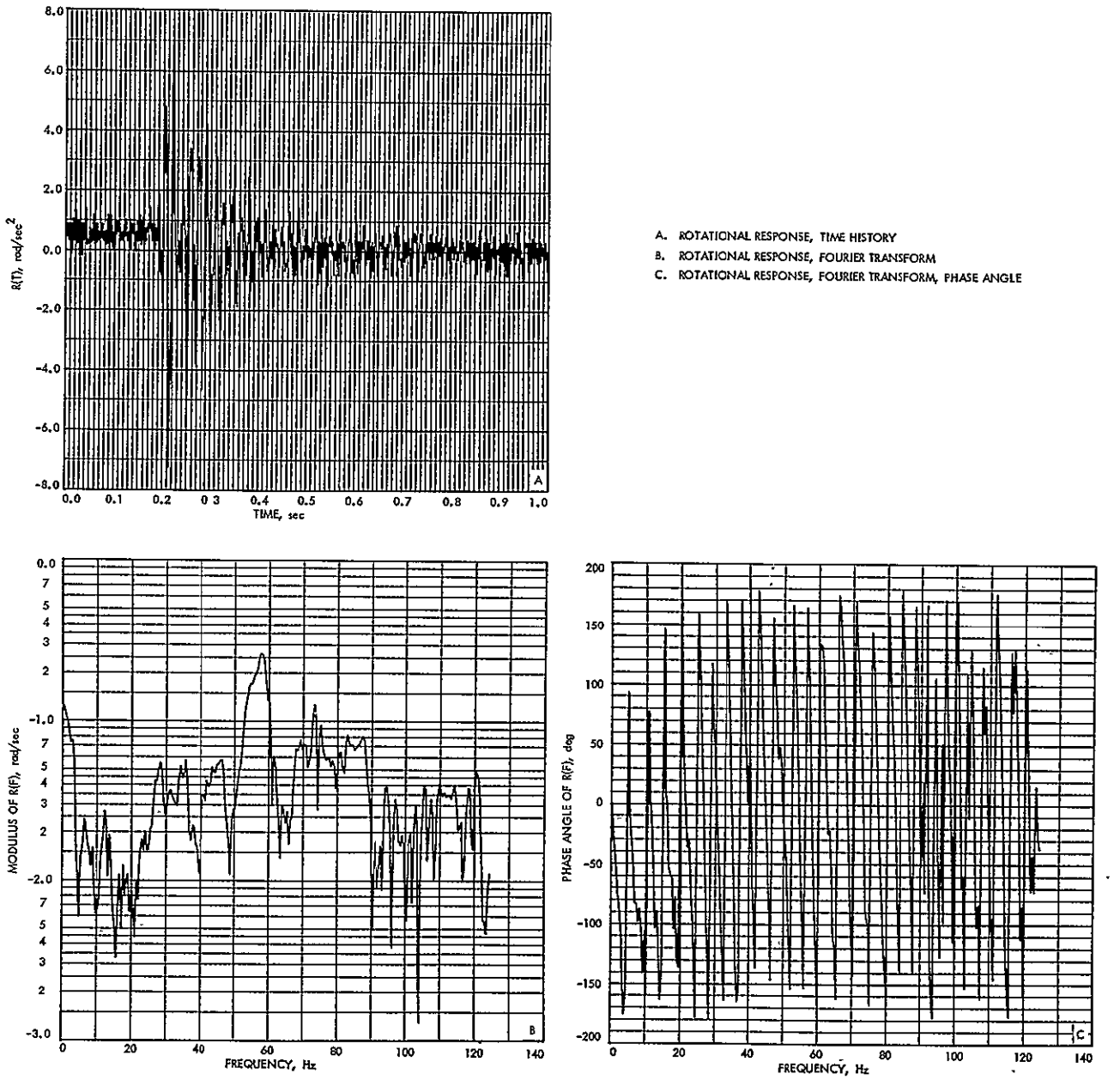

Fig. A29. Gridpoint 12, Rotational response in θ_y-direction at top of transition adapter obtained from the Orbiting Astronomical Observatory--Atlas/Centaur (AC-16) MECO flight data

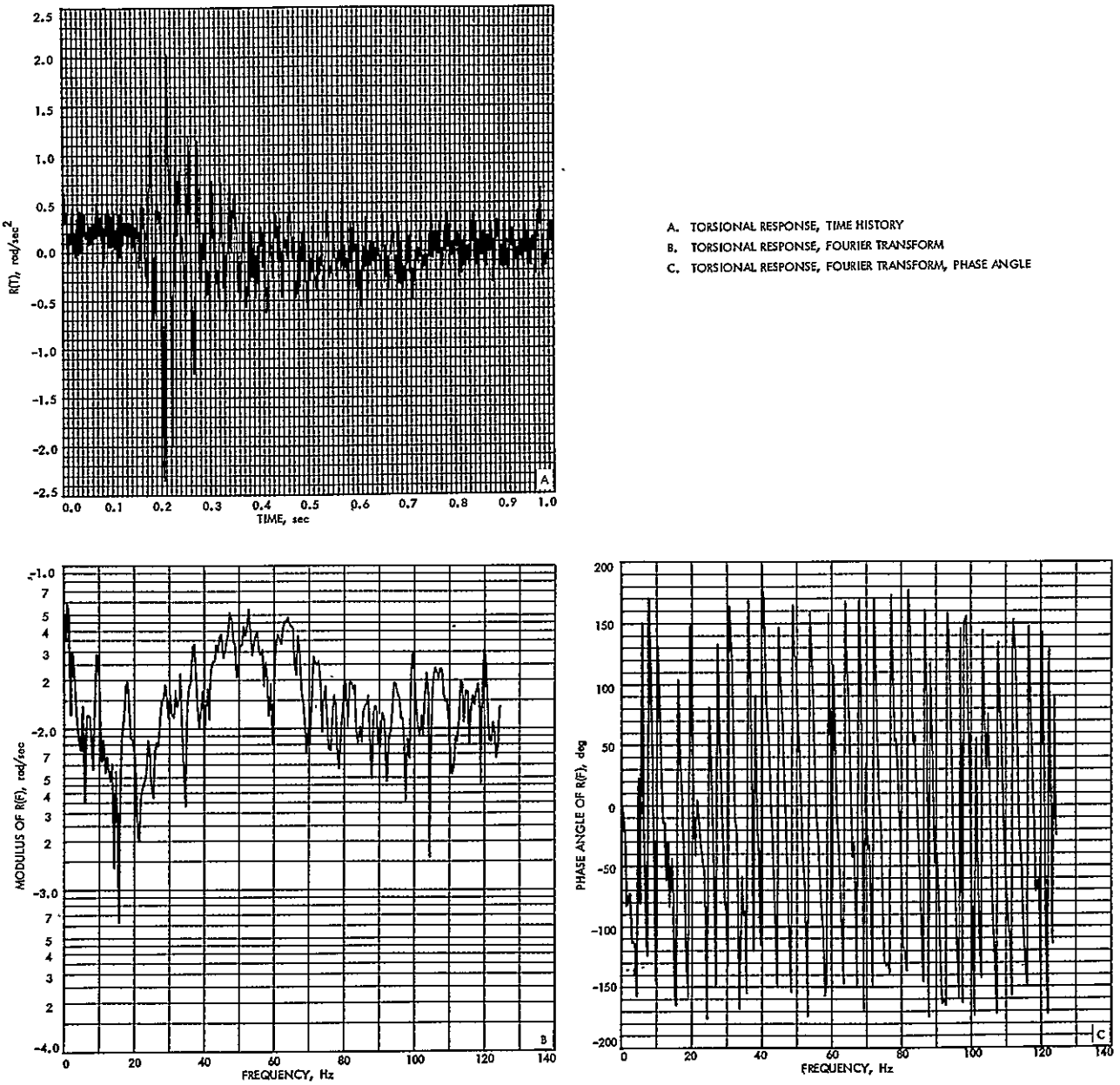

Fig. A30. Gridpoint 12, Torsional response in θ_z-direction at top of transition adapter obtained from the Orbiting Astronomical Observatory--Atlas/Centaur (AC-16) MECO flight data

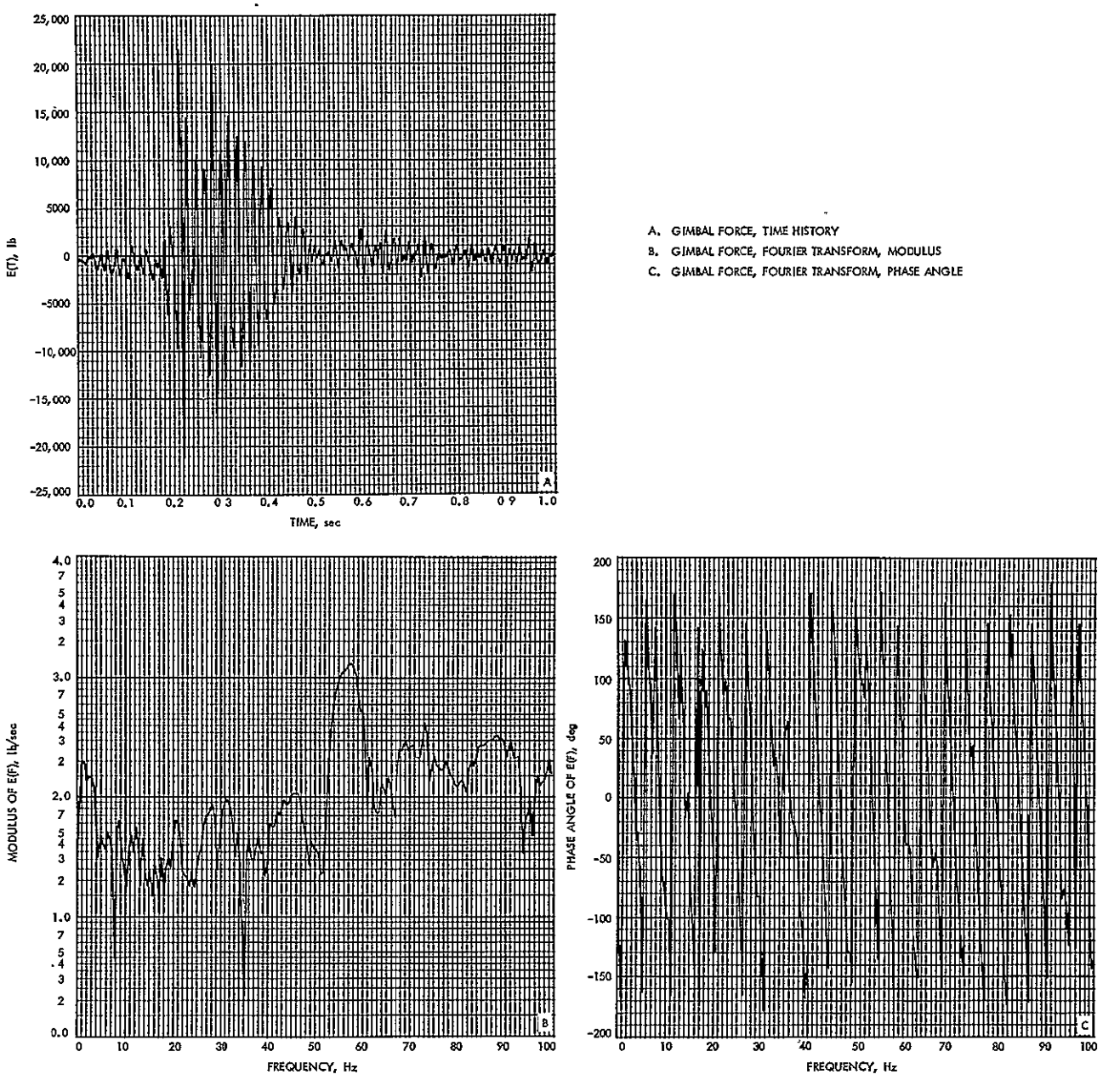

Fig. A31. Gridpoint 67, Centaur Gimbal Axis Forcing function in X - Direction Derived from OAO - Centaur (AC-16) flight data.

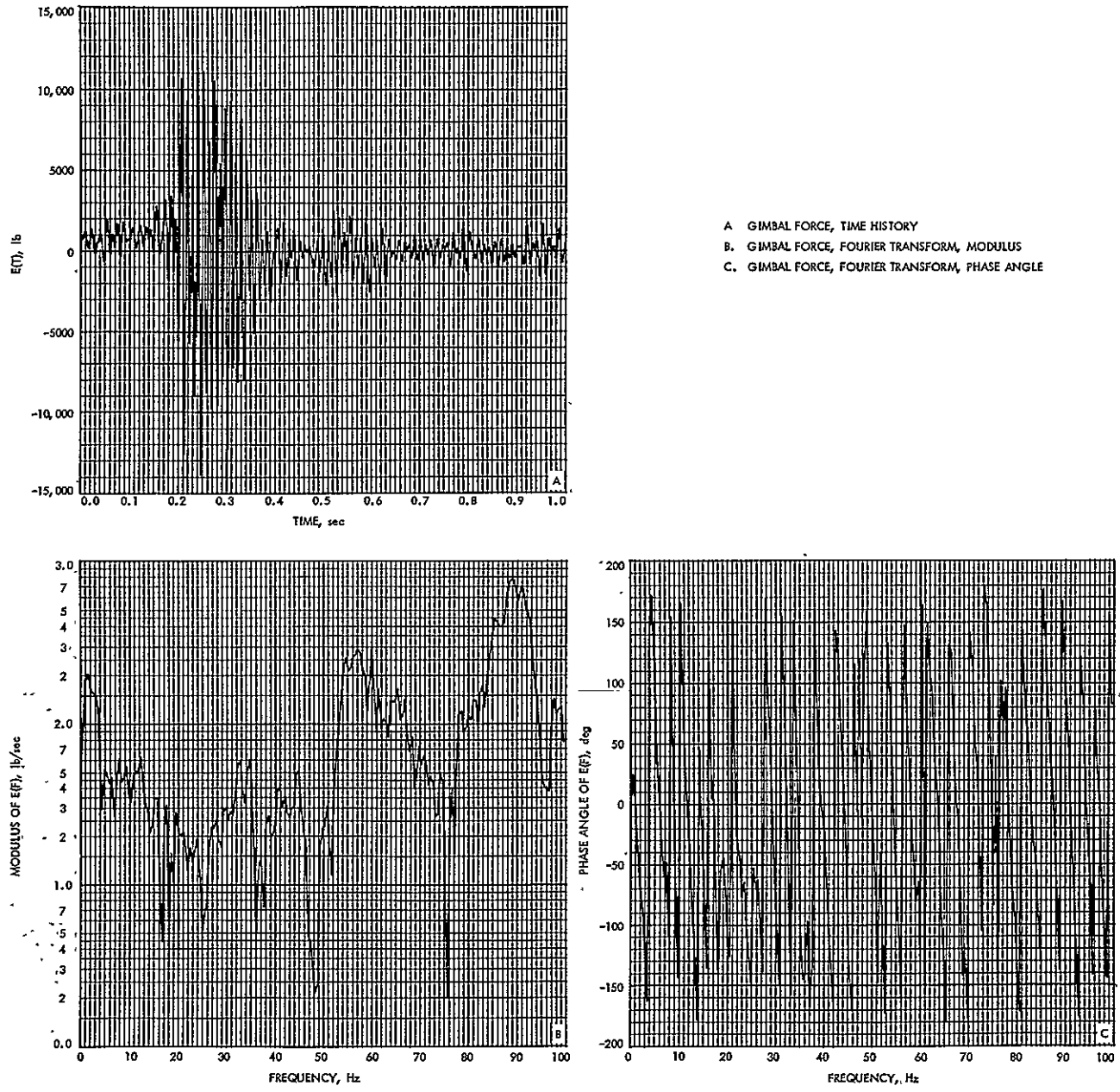

Fig. A32. Gridpoint 67, Centaur Gimbal Axis Forcing function in Y - Direction Derived from OAO - Centaur (AC-16) flight data.

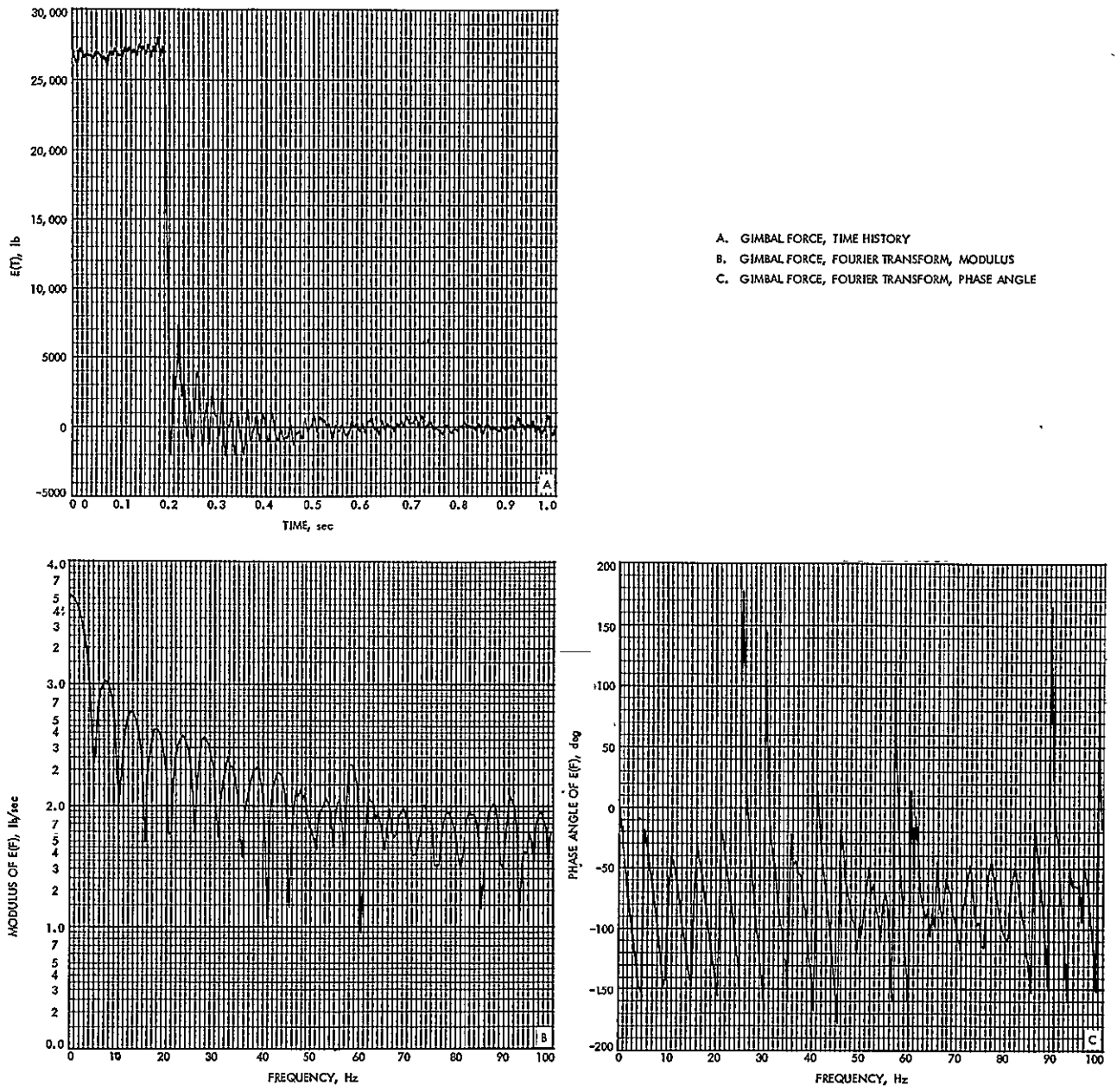

Fig. A33. Gridpoint 67, Centaur Gimbal Axis Forcing function in Z - Direction Derived from OAO - Centaur (AC-16) flight data.

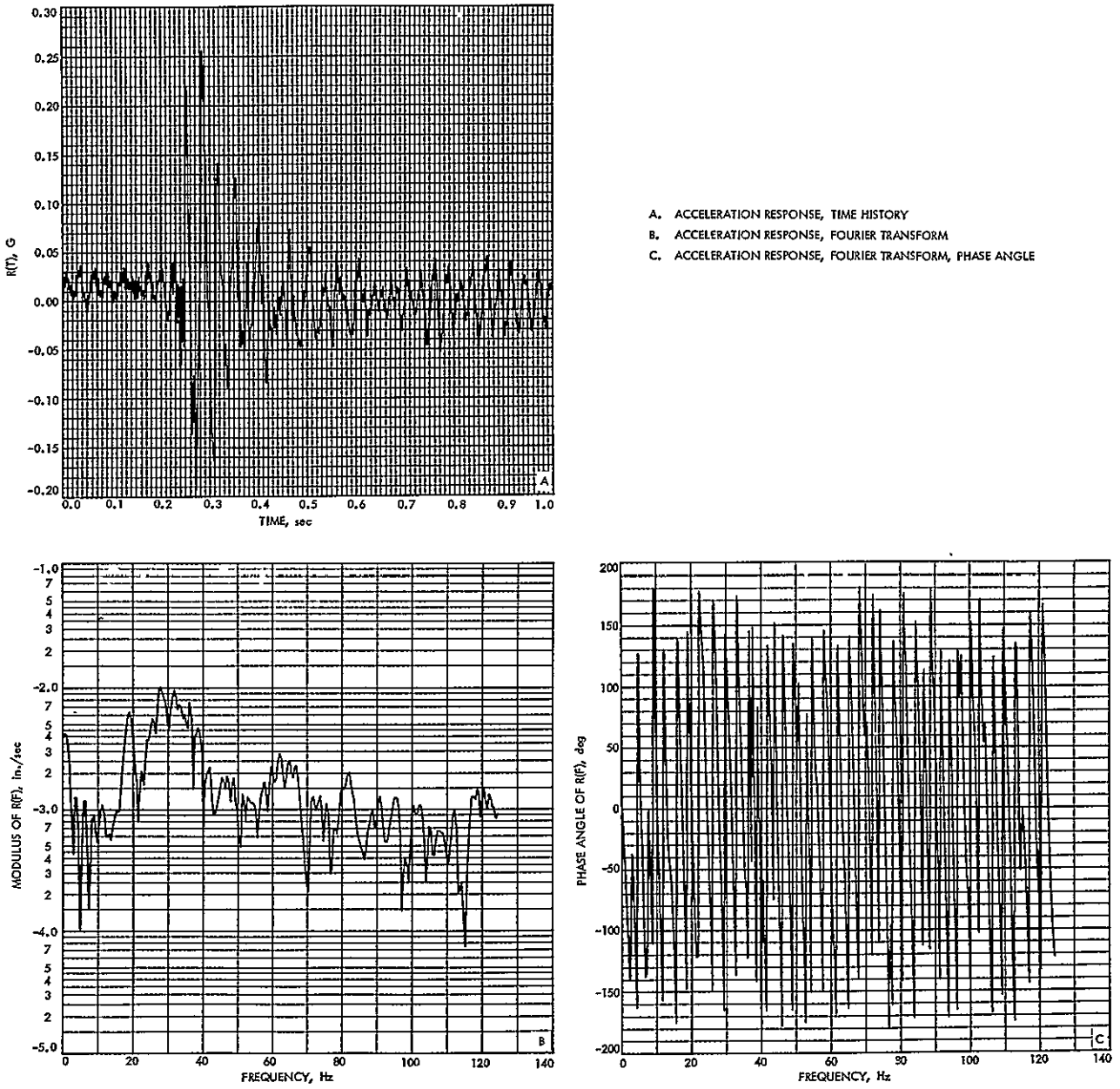

Fig. A34. Gridpoint 12, Acceleration response in X-direction at top of forward payload adapter obtained from the Application Technology Satellite--Atlas/Centaur (AC-17) MECO flight data

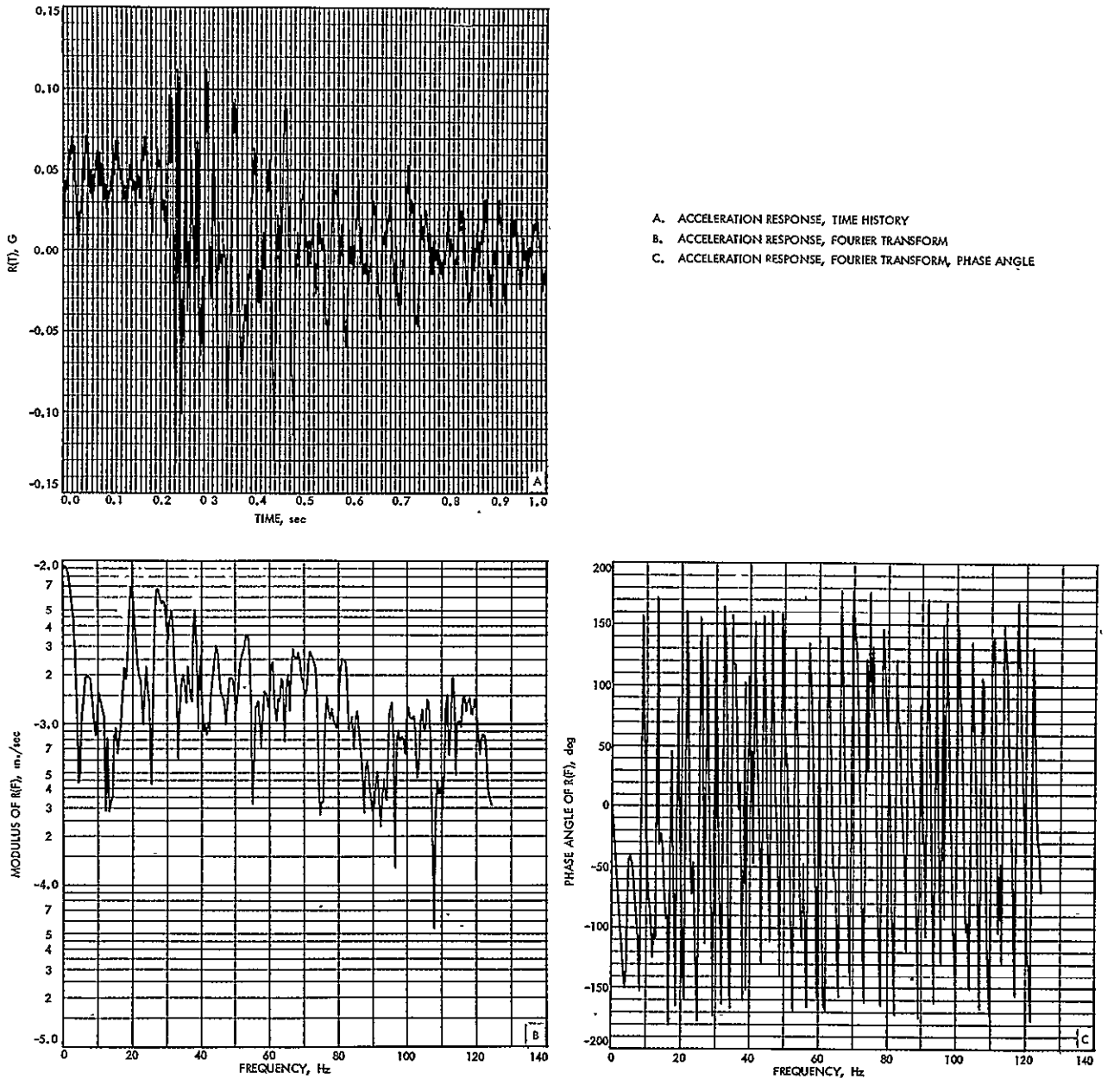

Fig. A35. Gridpoint 12, Acceleration response in Y-direction at top of forward payload adapter obtained from the Application Technology Satellite--Atlas/Centaur (AC-17) MECO flight data

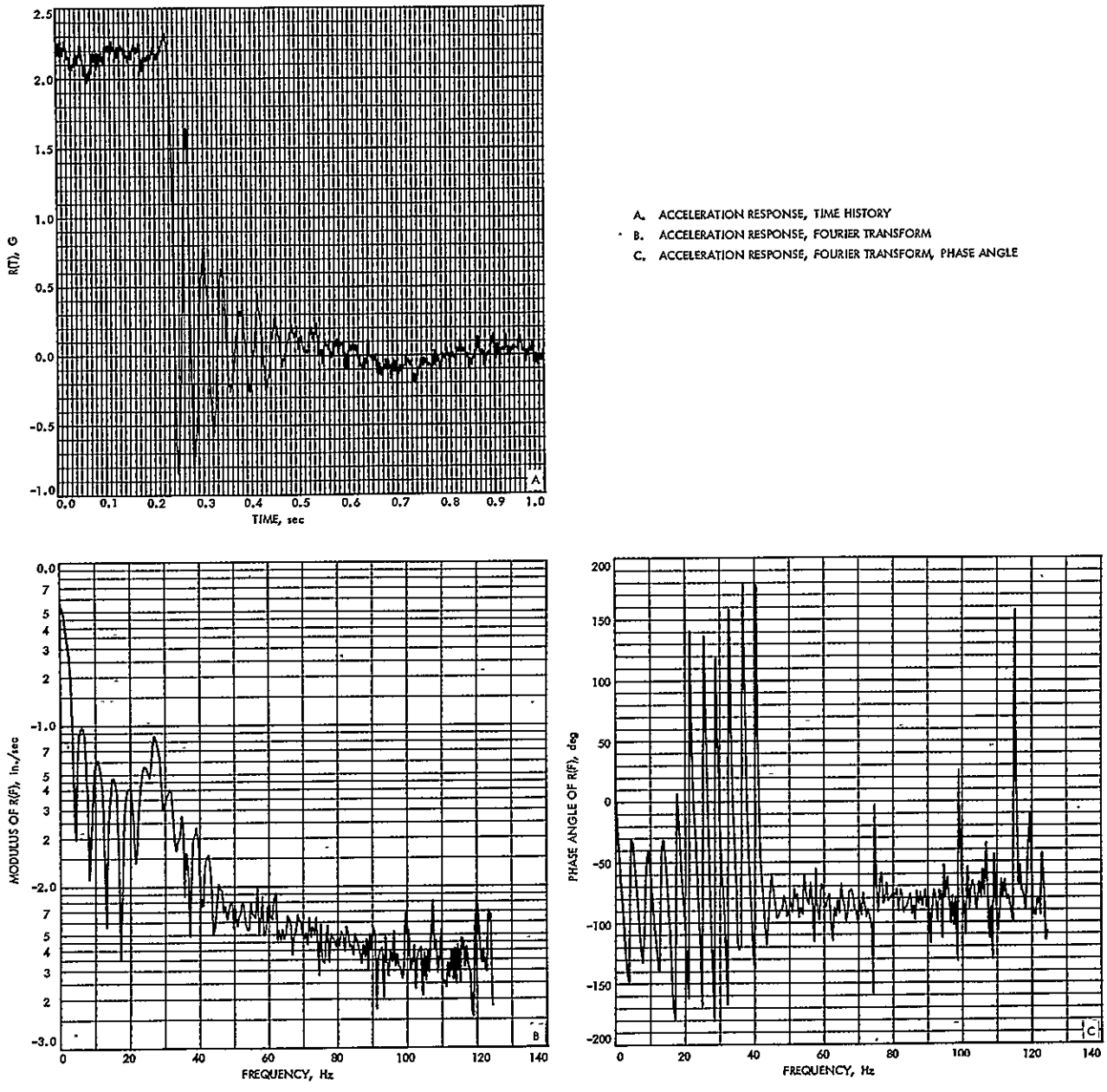

Fig. A36. Gridpoint 12, Acceleration response in Z-direction at top of forward payload adapter obtained from the Application Technology Satellite--Atlas/Centaur (AC-17) MECO flight data

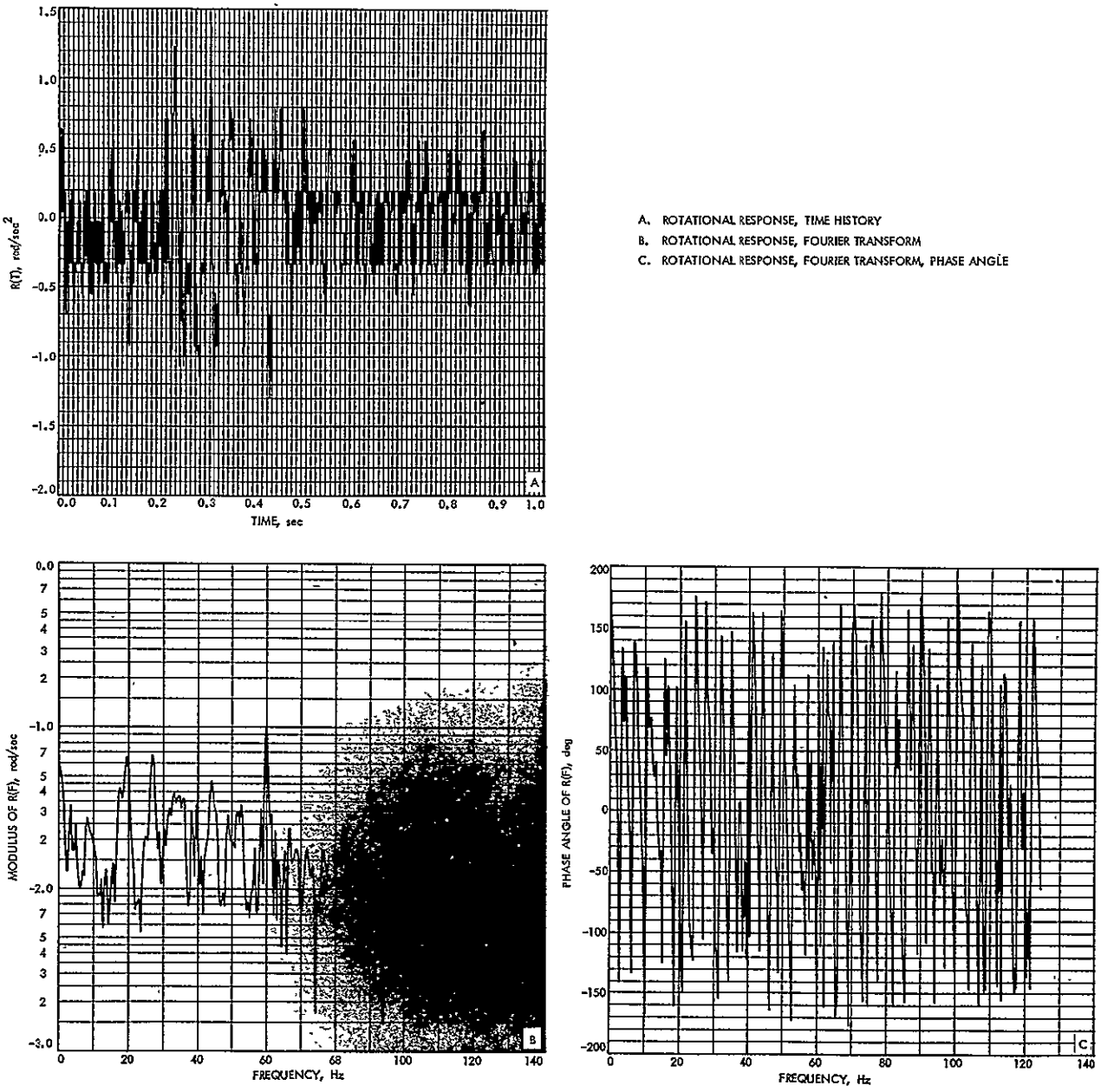

Fig. A37. Gridpoint 12, Rotational response in θ_x-direction at top of forward payload adapter obtained from the Application Technology Satellite--Atlas/Centaur (AC-17) MECO flight data

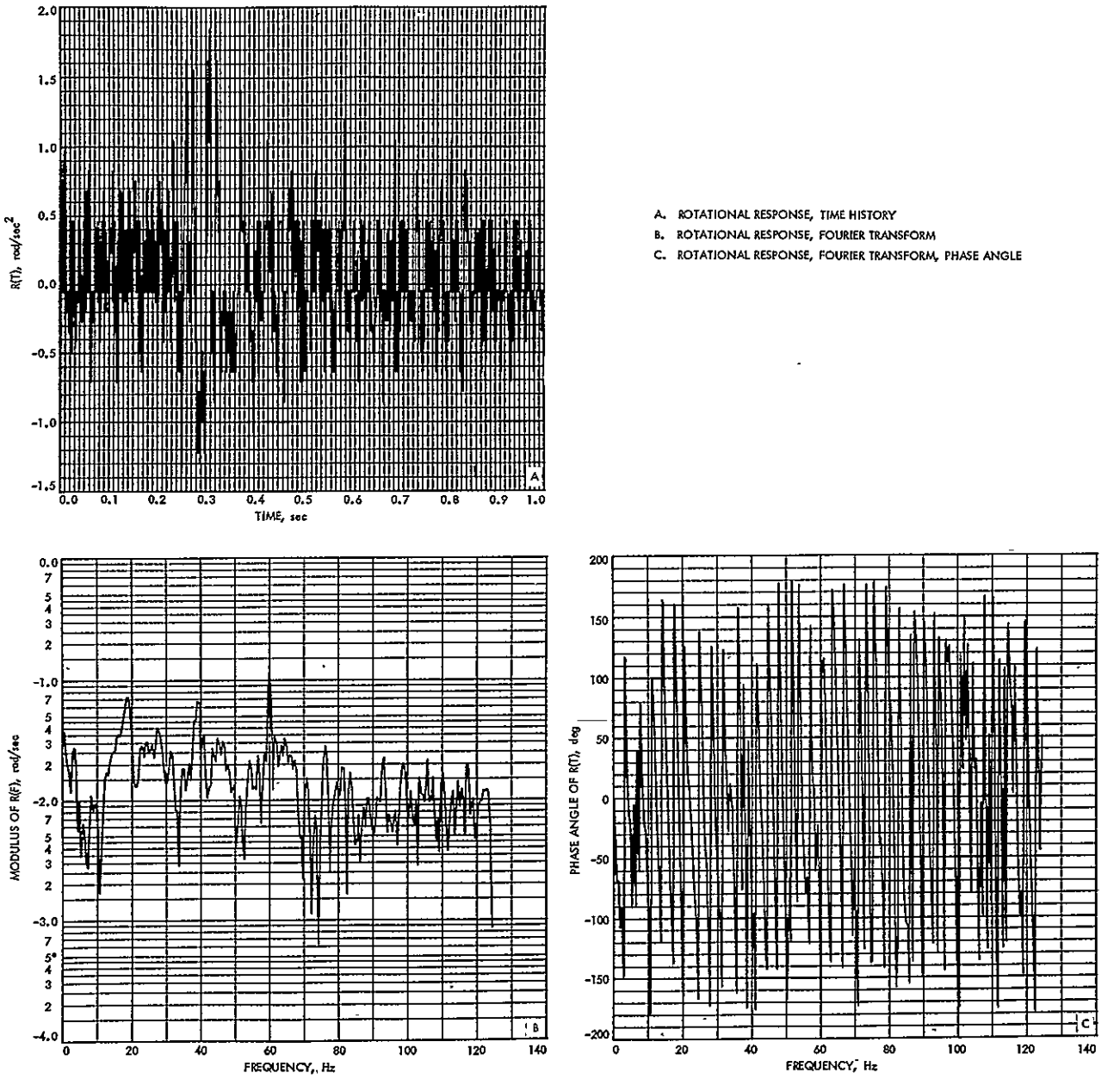

Fig. A38. Gridpoint 12, Rotational response in θ_y-direction at top of forward payload adapter obtained from the Application Technology Satellite--Atlas/Centaur (AC-17) MECO flight data

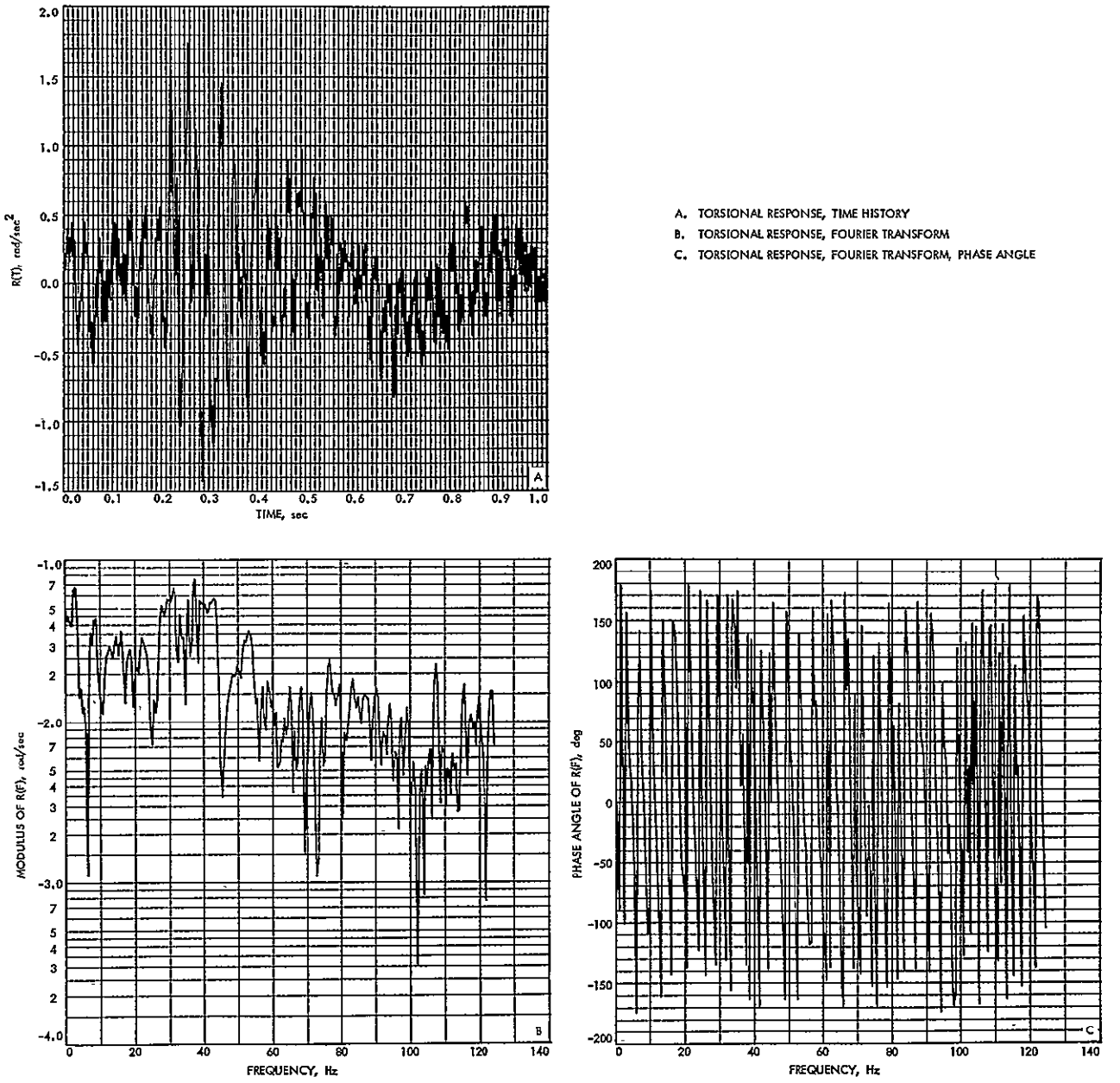

Fig. A39. Gridpoint 12, Torsional response in θ_Z-direction at top of forward payload adapter obtained from the Application Technology Satellite--Atlas/Centaur (AC-17) MECO flight data

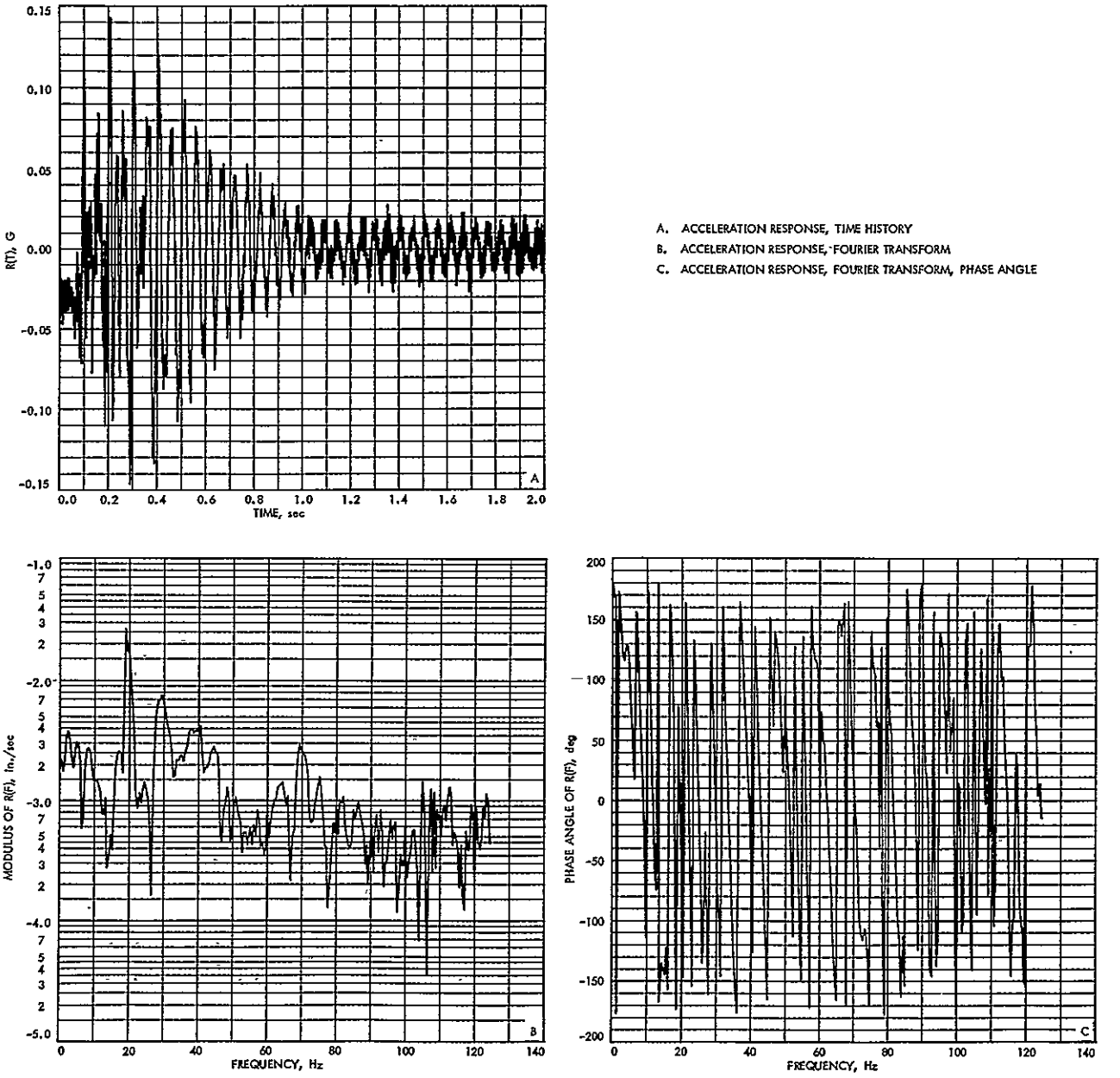

Fig. A40. Gridpoint 12, Acceleration response in X-direction at top of forward payload adapter obtained from the Application Technology Satellite--Atlas/Centaur (AC-18) MECO-I flight data

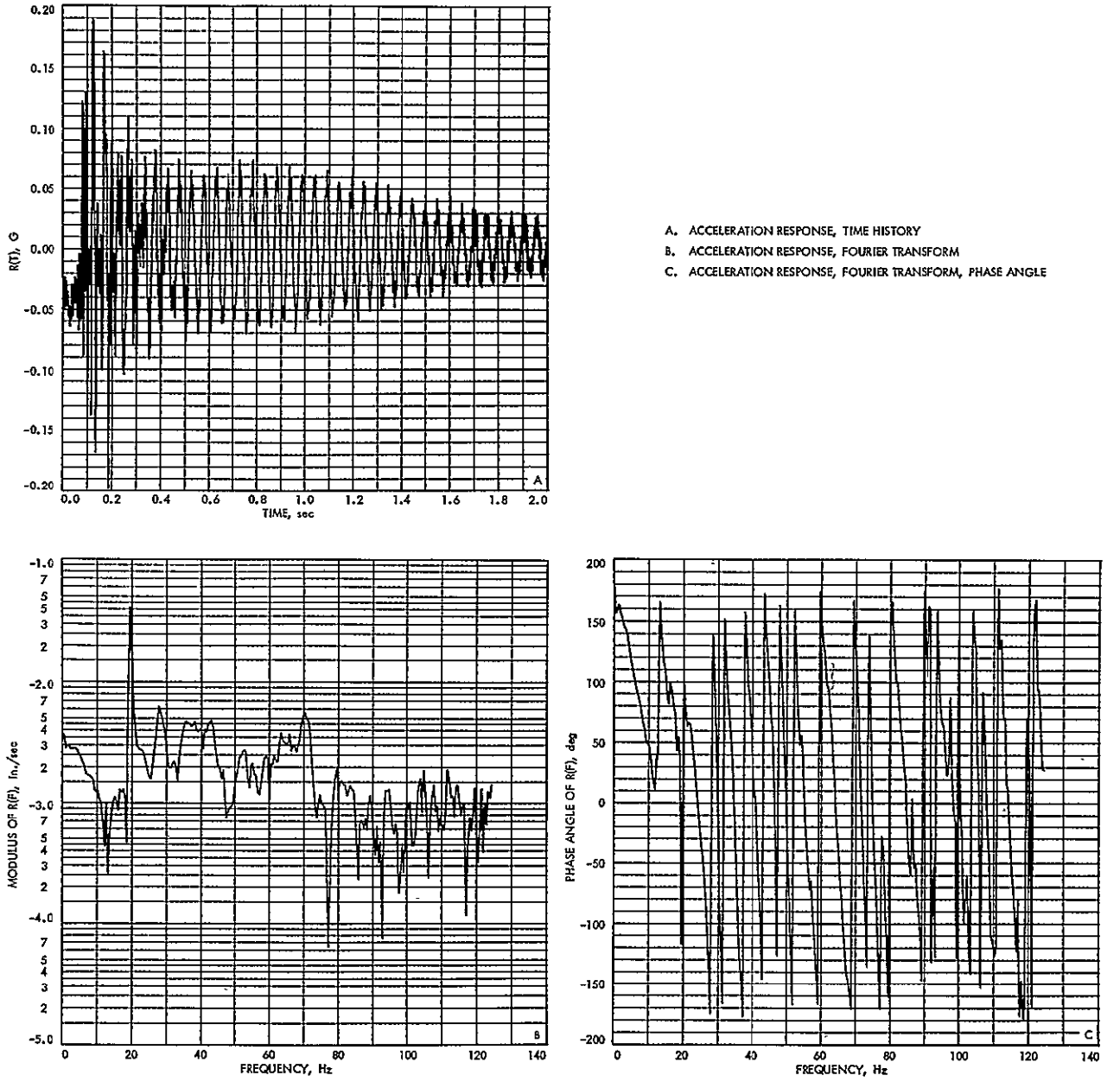

Fig. A41. Gridpoint 12, Acceleration response in Y-direction at top of forward payload adapter obtained from the Application Technology Satellite--Atlas/Centaur (AC-18) MECO-I flight data

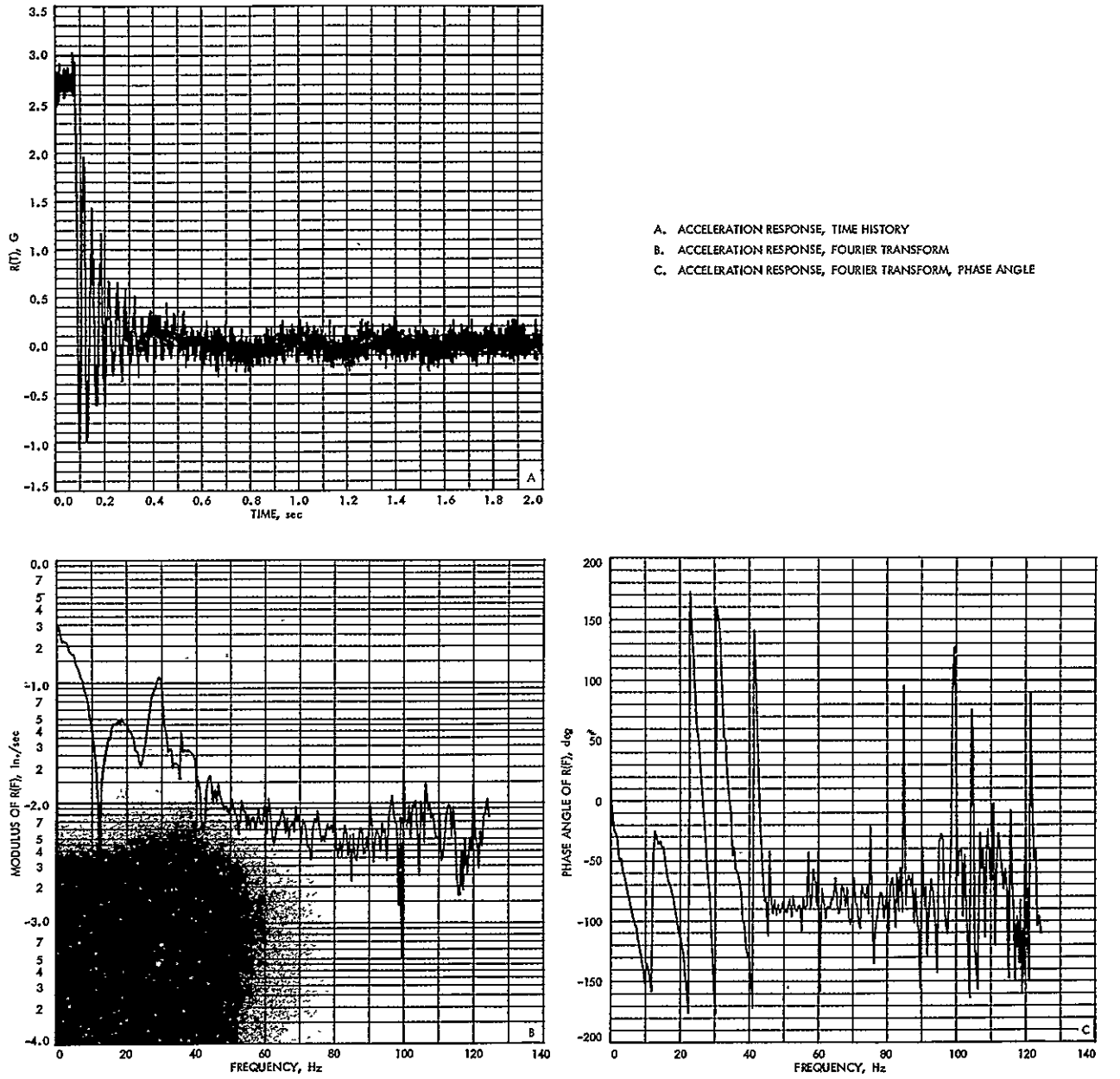

Fig. A42. Gridpoint 12, Acceleration response in Z-direction at top of forward payload adapter obtained from the Application Technology Satellite--Atlas/Centaur (AC-18) MECO flight data

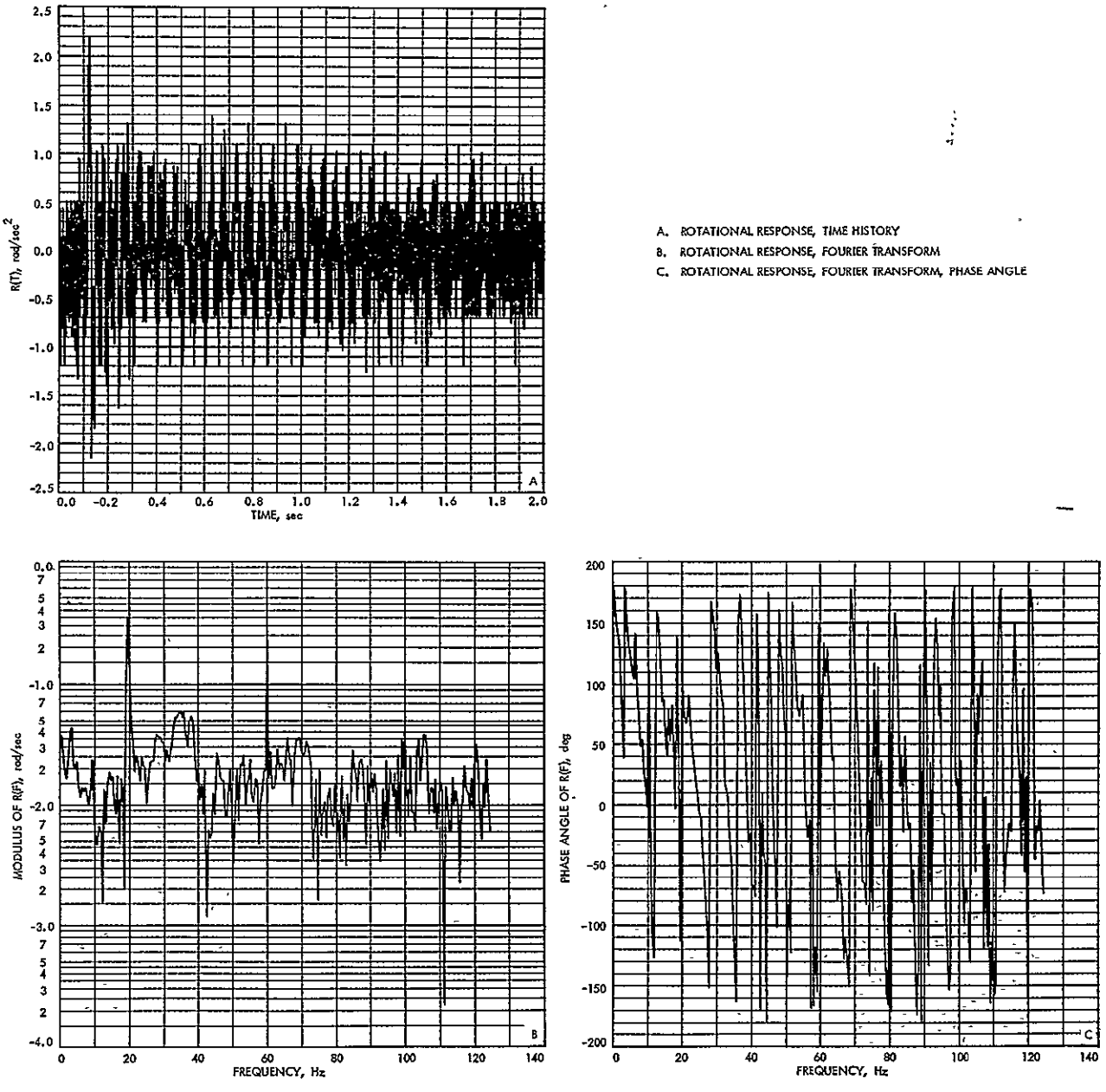

Fig. A43. Gridpoint 12, Rotational response in θ_x-direction at top of forward payload adapter obtained from the Application Technology Satellite--Atlas/Centaur (AC-18) MECO flight data

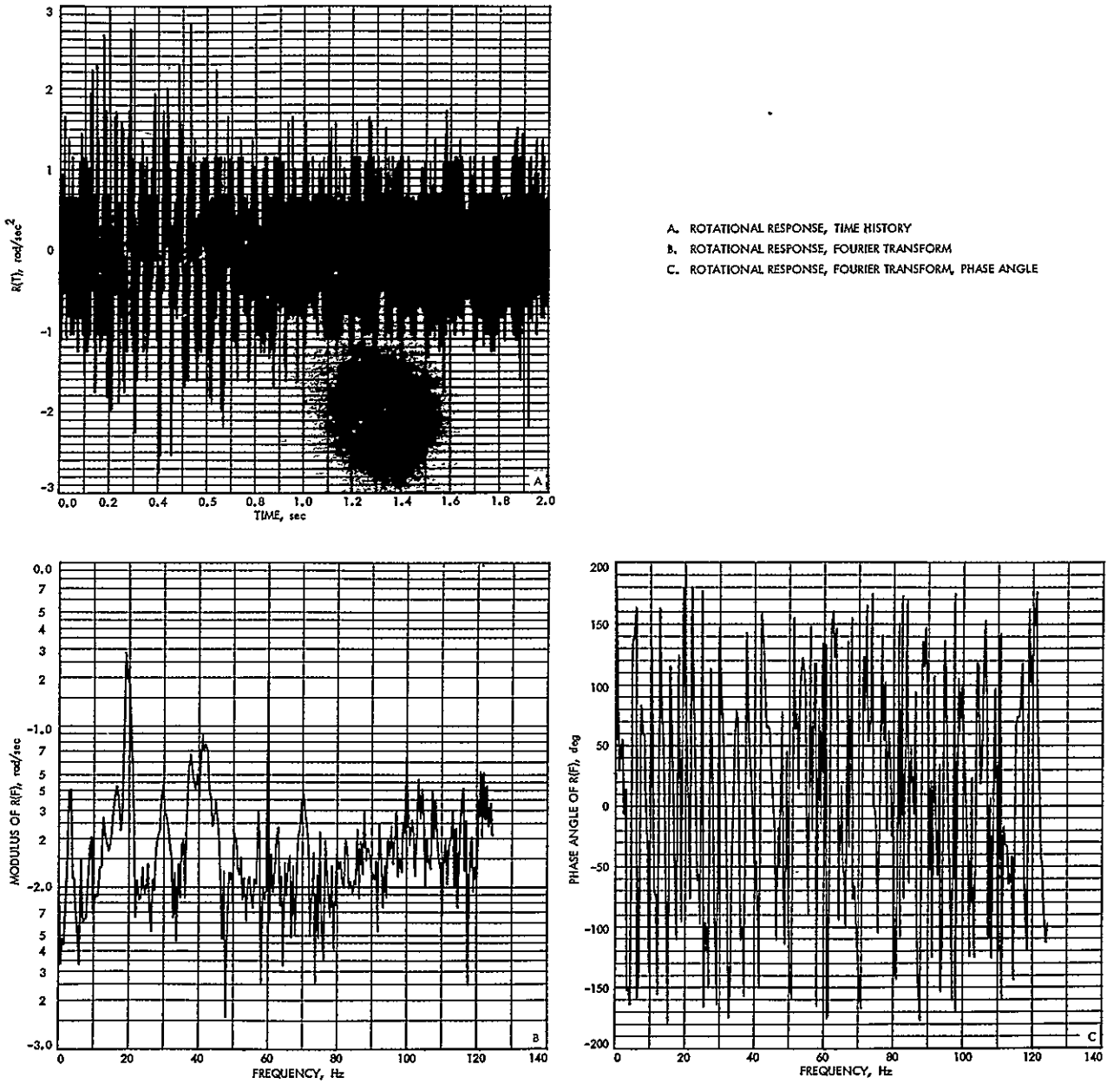

Fig. A44. Gridpoint 12, Rotational response in θ_y-direction at top of forward payload adapter obtained from the Application Technology Satellite--Atlas/Centaur (AC-18) MECO-I flight data

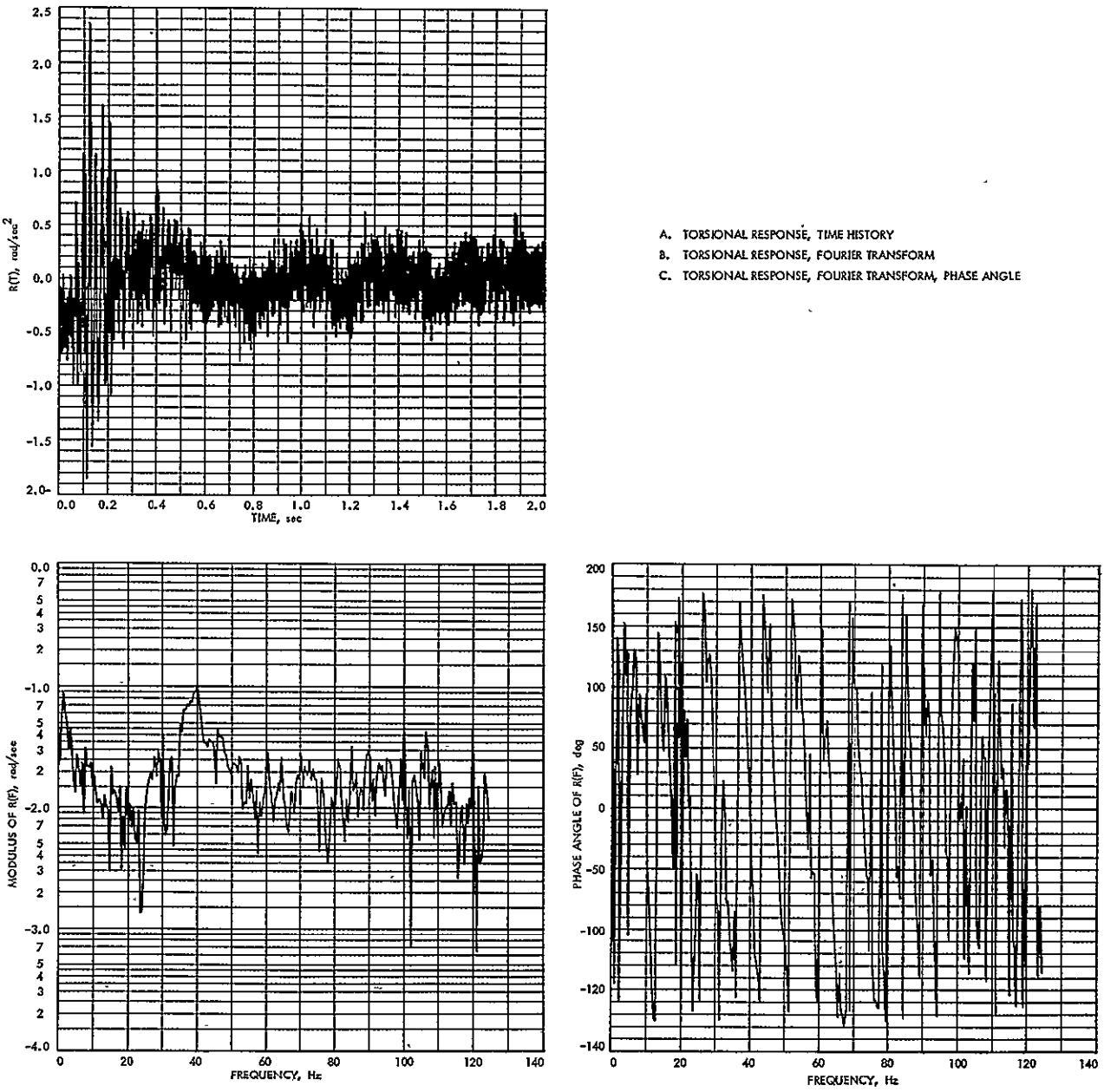

Fig. A45. Gridpoint 12, Torsional response in θ_Z-direction at top of forward payload adapter obtained from the Application Technology Satellite--Atlas/Centaur (AC-18) MECO-II flight data

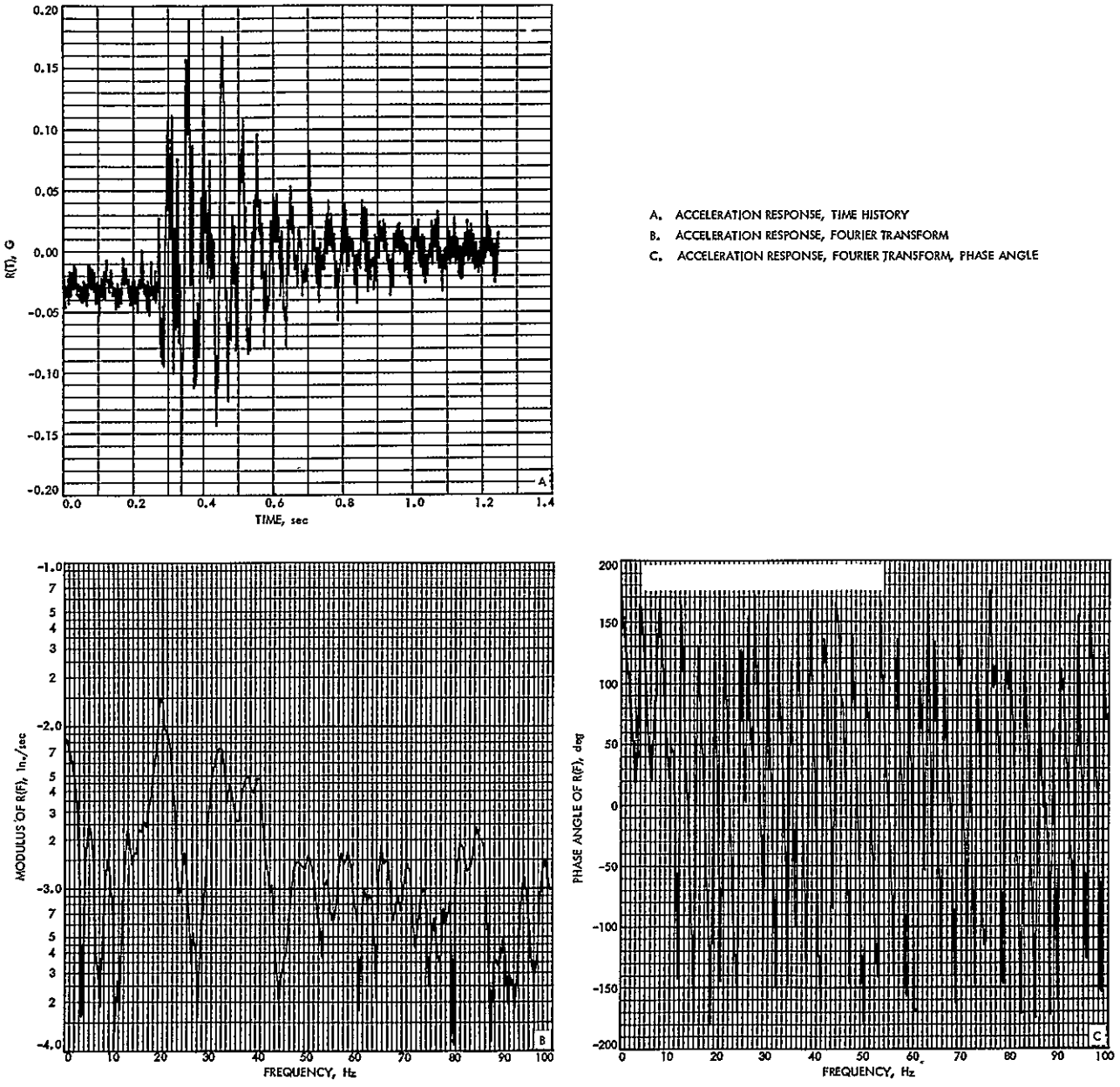

Fig. A46. Gridpoint 12, Acceleration response in X-direction at top of forward payload adapter obtained from the Application Technology Satellite--Atlas/Centaur (AC-18) MECO-II flight data

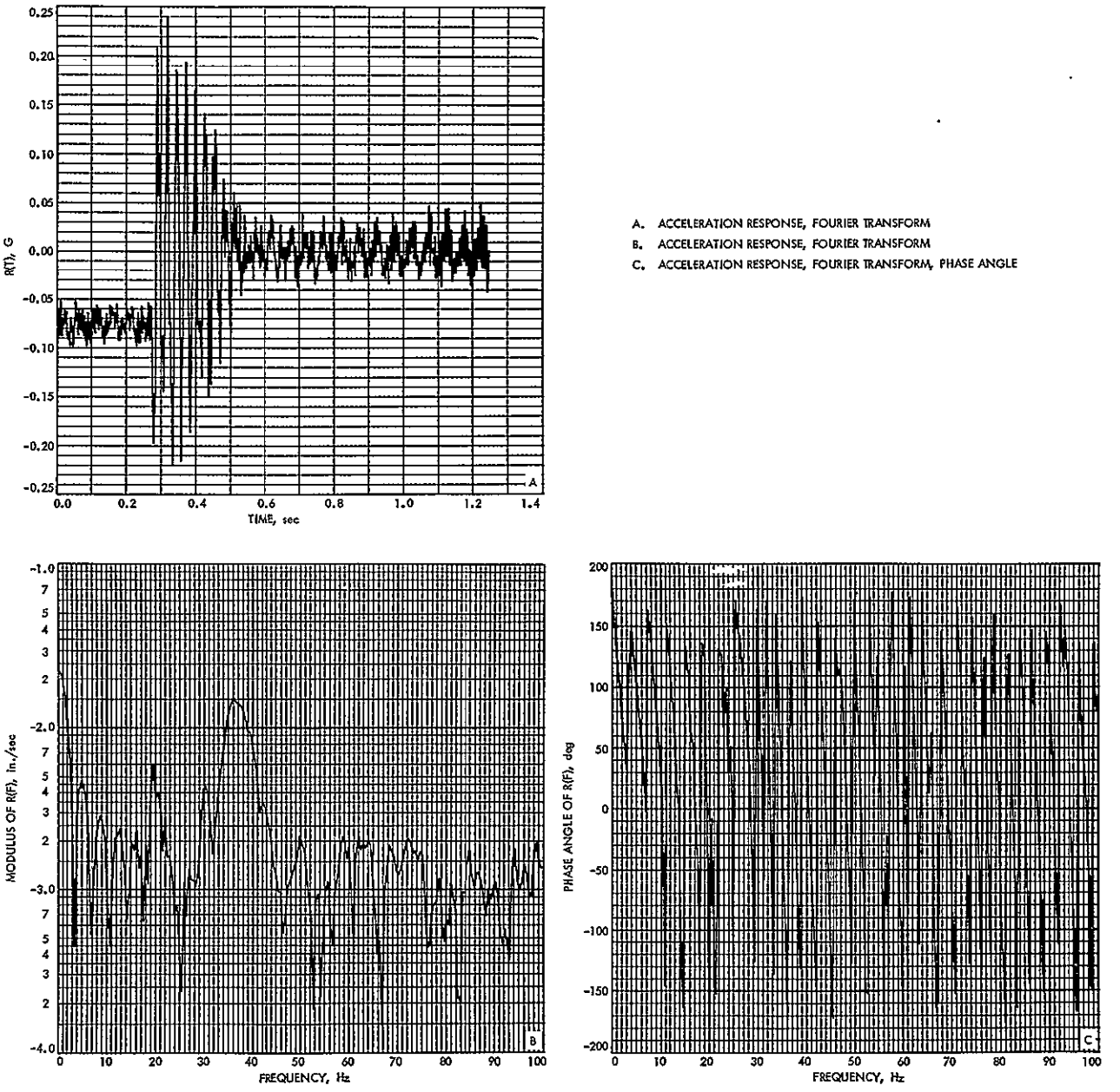

Fig. A47. Gridpoint 12, Acceleration response in Y-direction at top of forward payload adapter obtained from the Application Technology Satellite--Atlas/Centaur (AC-18) MECO-II flight data

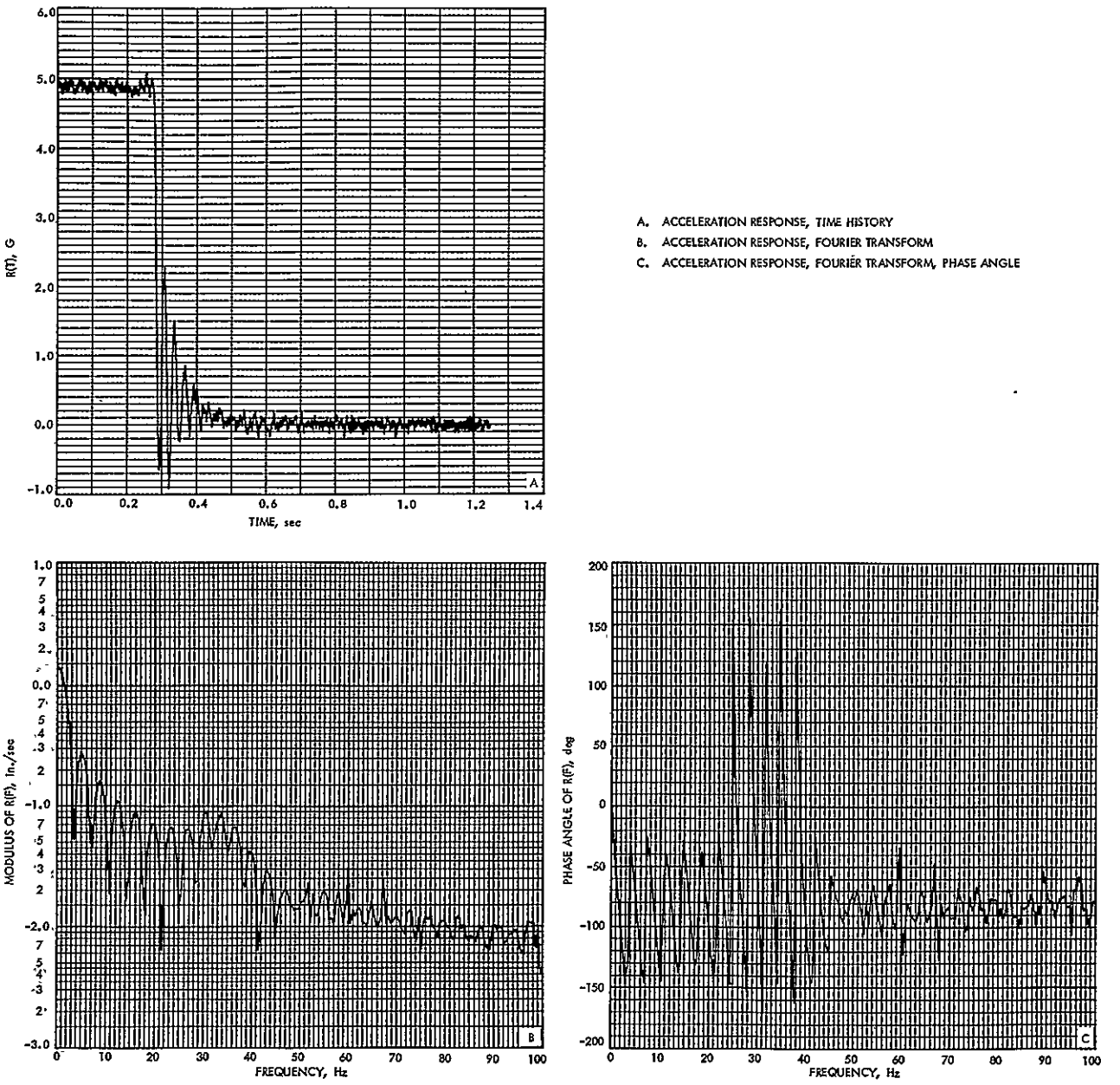

Fig. A48. Gridpoint 12, Acceleration response in Z-direction at top of forward payload adapter obtained from the Application Technology Satellite--Atlas/Centaur (AC-18) MECO-II flight data

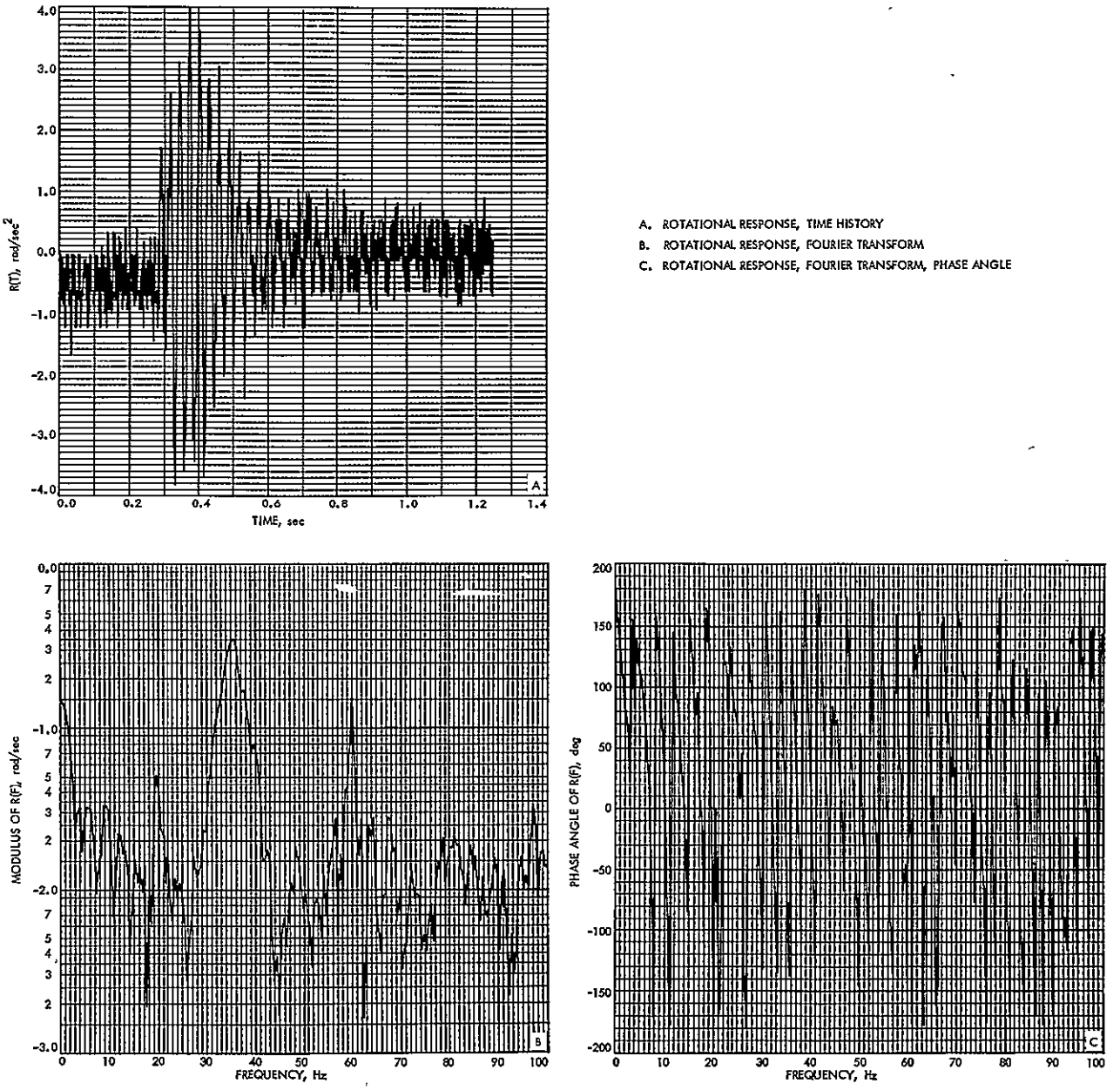

Fig. A49. Gridpoint 12, Rotational response in θ_x-direction at top of forward payload adapter obtained from the Application Technology Satellite--Atlas/Centaur (AC-18) MECO-II flight data

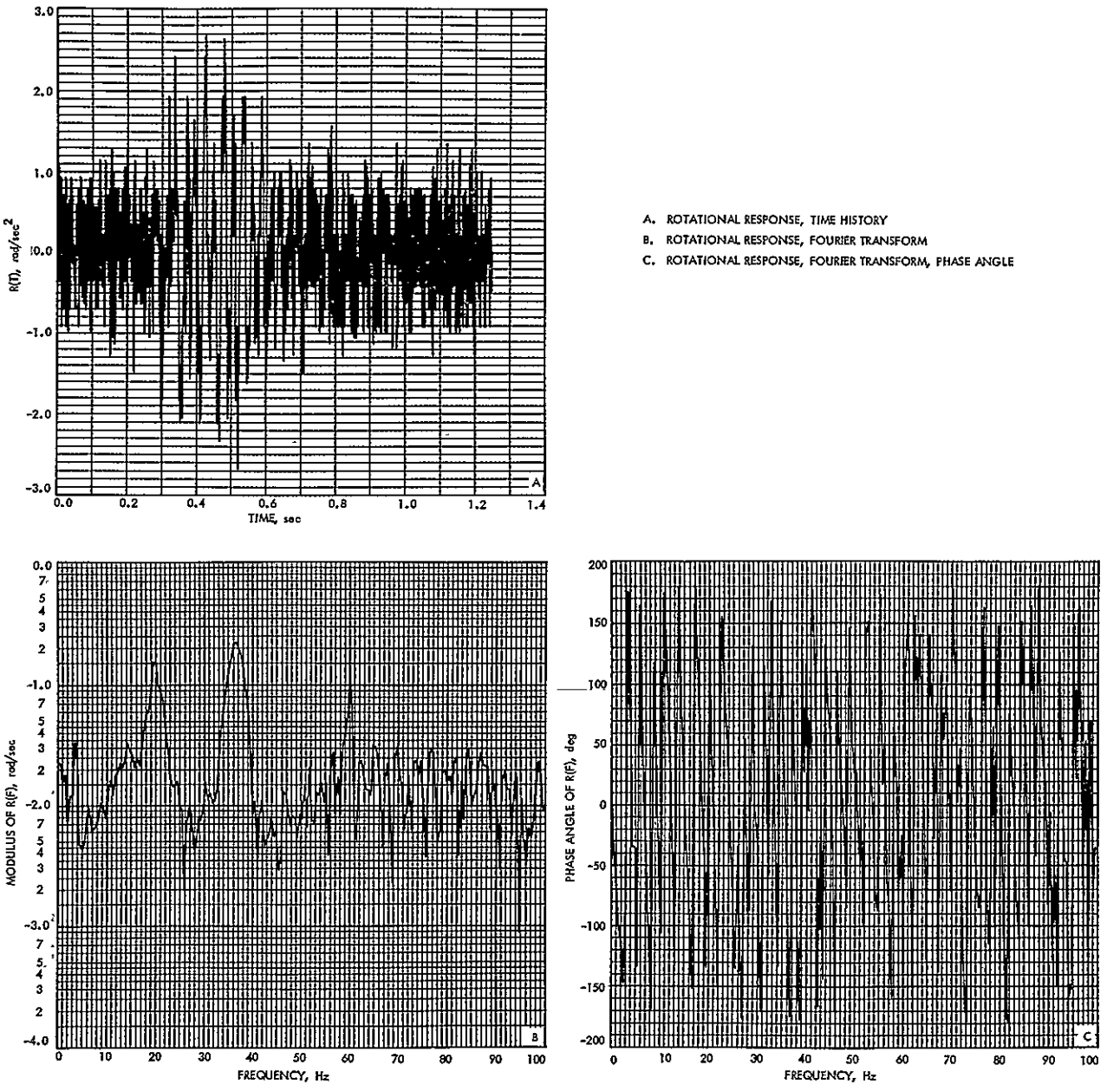

Fig. A50. Gridpoint 12, Rotational response in the θ_y-direction at top of forward payload adapter obtained from the Application Technology Satellite--Atlas/Centaur (AC-18) MECO-II flight data

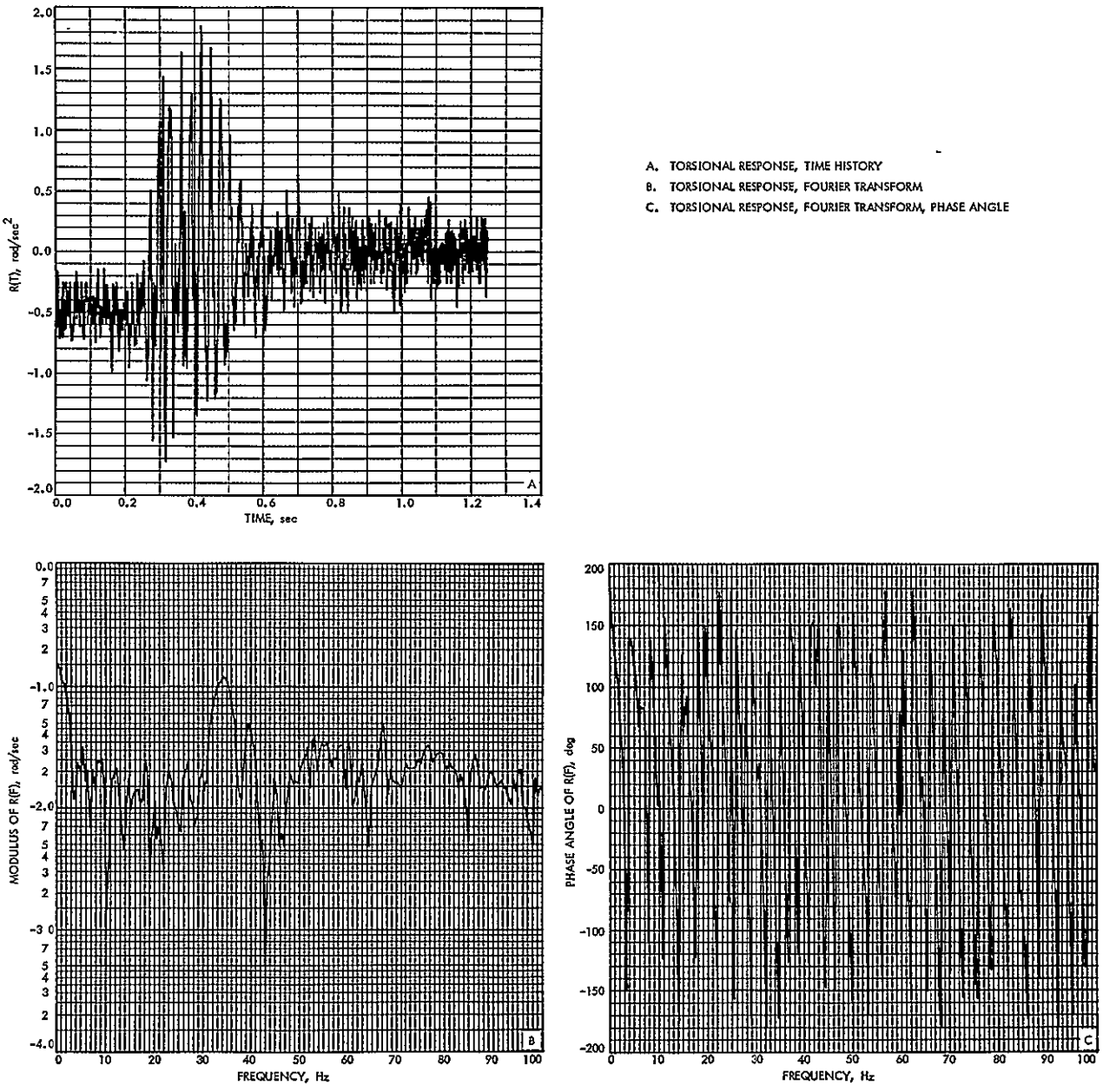

Fig. A51. Gridpoint 12, Torsional response in θ_Z-direction at top of forward payload adapter obtained from the Application Technology Satellite--Atlas/Centaur (AC-18) MECO-II flight data

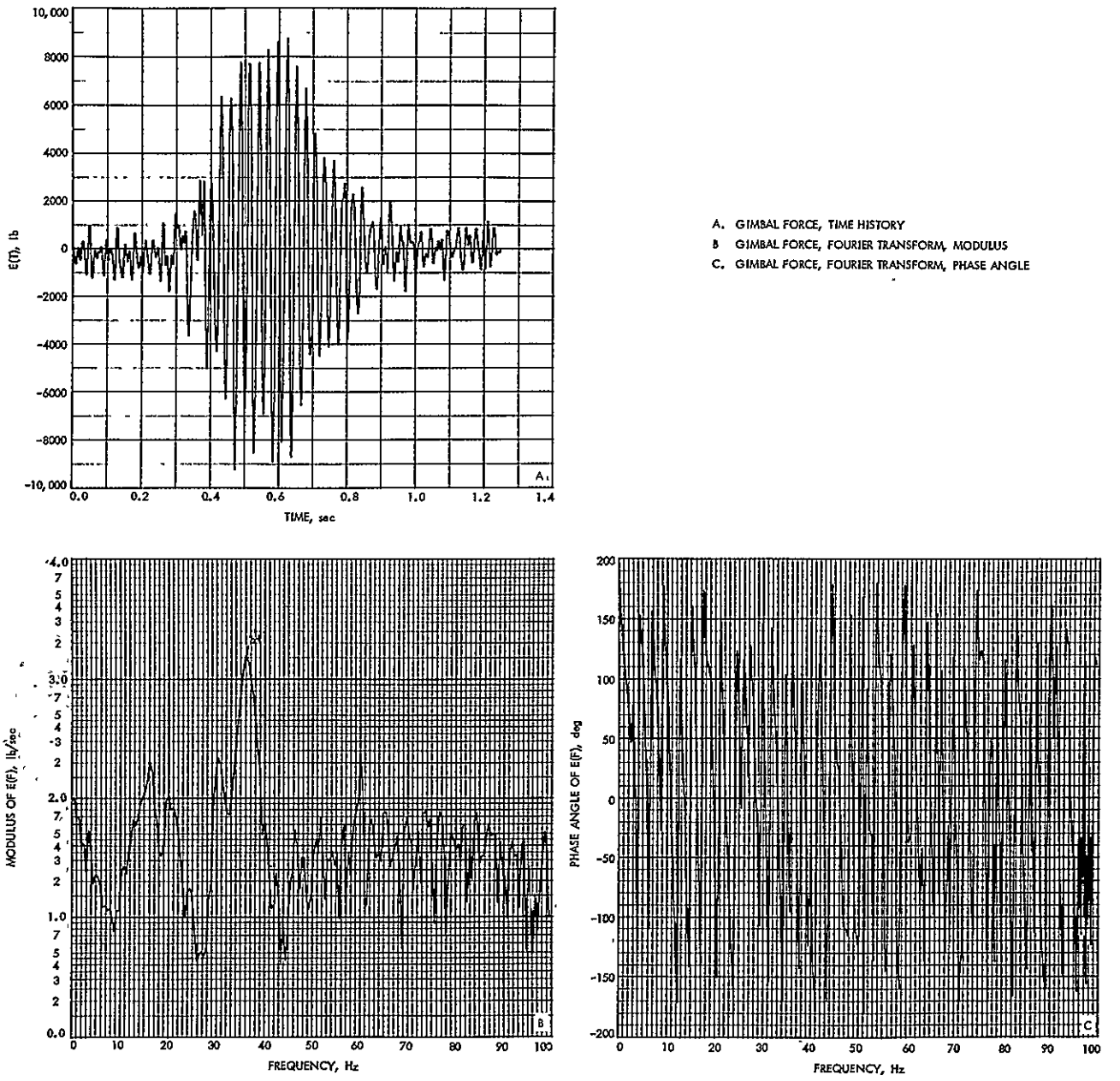

Fig. A52. Gridpoint 67, Centaur gimbal axis forcing function in X-direction derived from ATS--Centaur (AC-18) MECO-II flight data

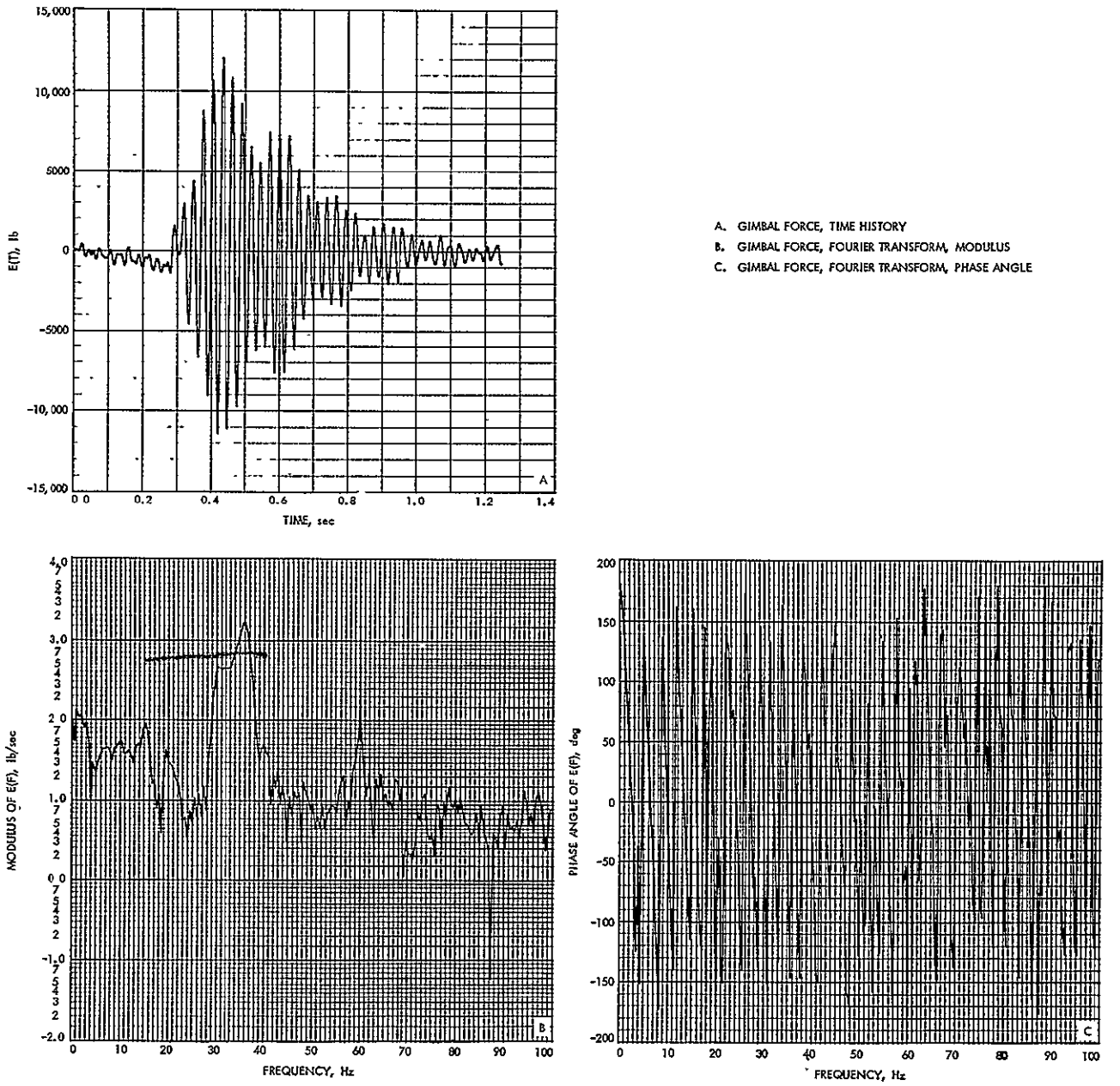

Fig. A53. Gridpoint 67, Centaur gimbal axis forcing function in Y-direction derived from Mariner VI--Atlas/Centaur (AC-20) MECO flight data

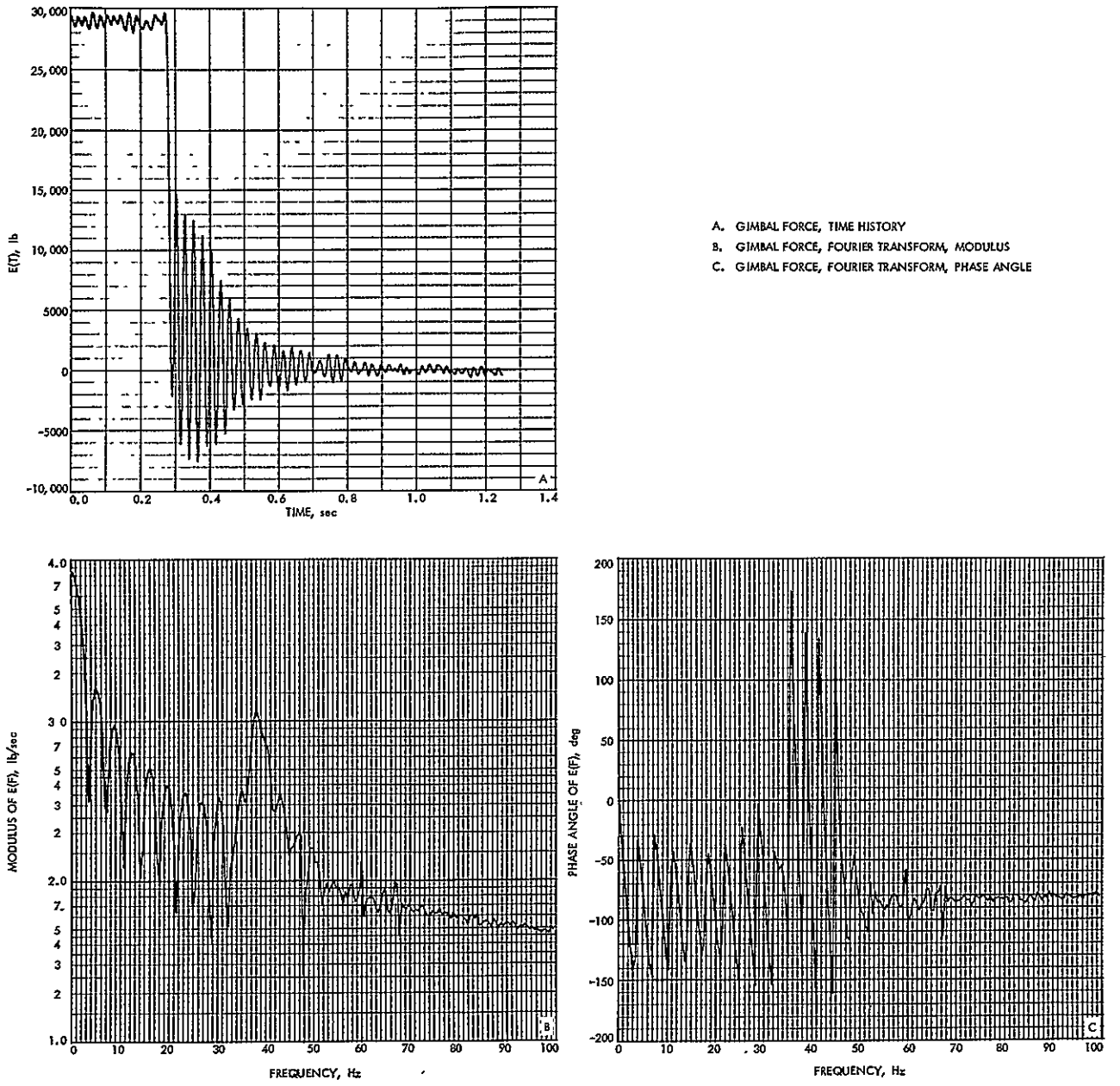

Fig. A54. Gridpoint 67, Centaur gimbal axis forcing function in Z-direction derived from ATS--Centaur (AC-18) MECO-II flight data

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