

# Radiation Testing of XMM EPIC MOS Preamps

A F Abbey - Leicester University - 24 July 1996

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## 0. Document History

24 July 1996 Initial Version

## 1. Introduction

Sector analysis has shown that the operational amplifiers for XMM EPIC MOS cameras could receive quite a high dose of radiation in the 10 year mission. The figures quoted in the Dornier radiation analysis document of 21 June 1995 show 132kRads for EMCH1, and 116kRads for EMCH2 for dose behind 1mm of aluminium. In order to reduce the dose to the active components on the camera board, aluminium screening caps of 4mm thickness have been built into the boards, but it was thought desirable to perform radiation testing on sample devices. It was also pointed out that in the Co60 test facility the radiation protection caps would not reduce the dose, being only suitable for reduction of electrons and protons in the space environment rather than gammas. The OP37's have been purchased as one wafer batch from Analog Devices, and a section of the camera board was made into a test circuit board in order to test the radiation properties of a pair of the amplifiers. The board was taken to the total dose radiation facility at Estec and tested between the 10 and 11th of July 1996 to a total dose of 190kRads.

## 2. Equipment Used

The op amp test board contained two OP37s connected in non-inverting mode with a gain of 11. The input was AC coupled, but the output was DC coupled so that the DC offset could be measured. The circuit diagram of one channel is shown in figure 1.

The total dose facility in the QCA department at ESTEC was used for the tests, and consisted of a 1740 curie Co60 source (Gammabeam 150) with a collimated beam. The dosimetry was provided by a 0.6 cc ion chamber with Ionex Dosemaster 2590 display which recorded dose rate, total dose and elapsed time. Len Adams of the QCA department supervised the tests and provided the following electronic test equipment for measuring the op amps' performance:

Dual power supply E018-0.6D  
 Fluke 8050A and 8600A DVMs  
 HP function generator 8116A  
 Tektronix 2465 oscilloscope

The power supplies, signal generator and scope were connected via feedthroughs through the walls of the facility so that the amplifiers could be monitored continuously from outside the radiation area.

## 3. The Tests

Firstly, measurements were made at Leicester of frequency response from 1kHz to 2MHz before irradiation, using a Wavetek model 180 function generator and Tequipment D83 oscilloscope. After the irradiation another frequency scan was made at Leicester. In both cases the input was around 0.32 to 0.33V p-p, and it was noted that a peak in the frequency response was amplitude dependent presumably due to slew rate limiting.

For the tests at Estec the preamps were fed with +/-12V supplies and the signal inputs with around 200mV

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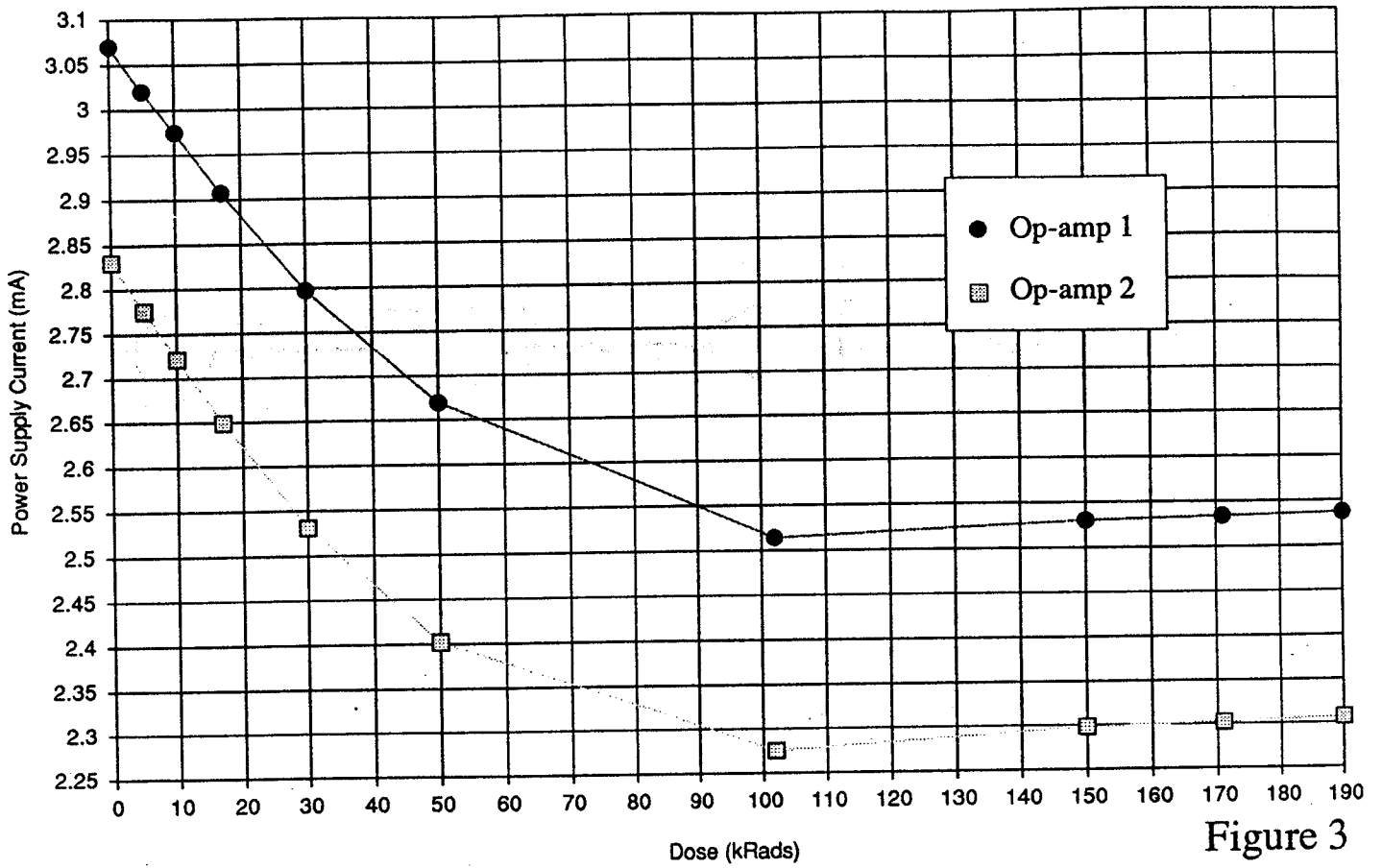


Figure 3

Radiation Testing of XMM EPIC MOS Preamps

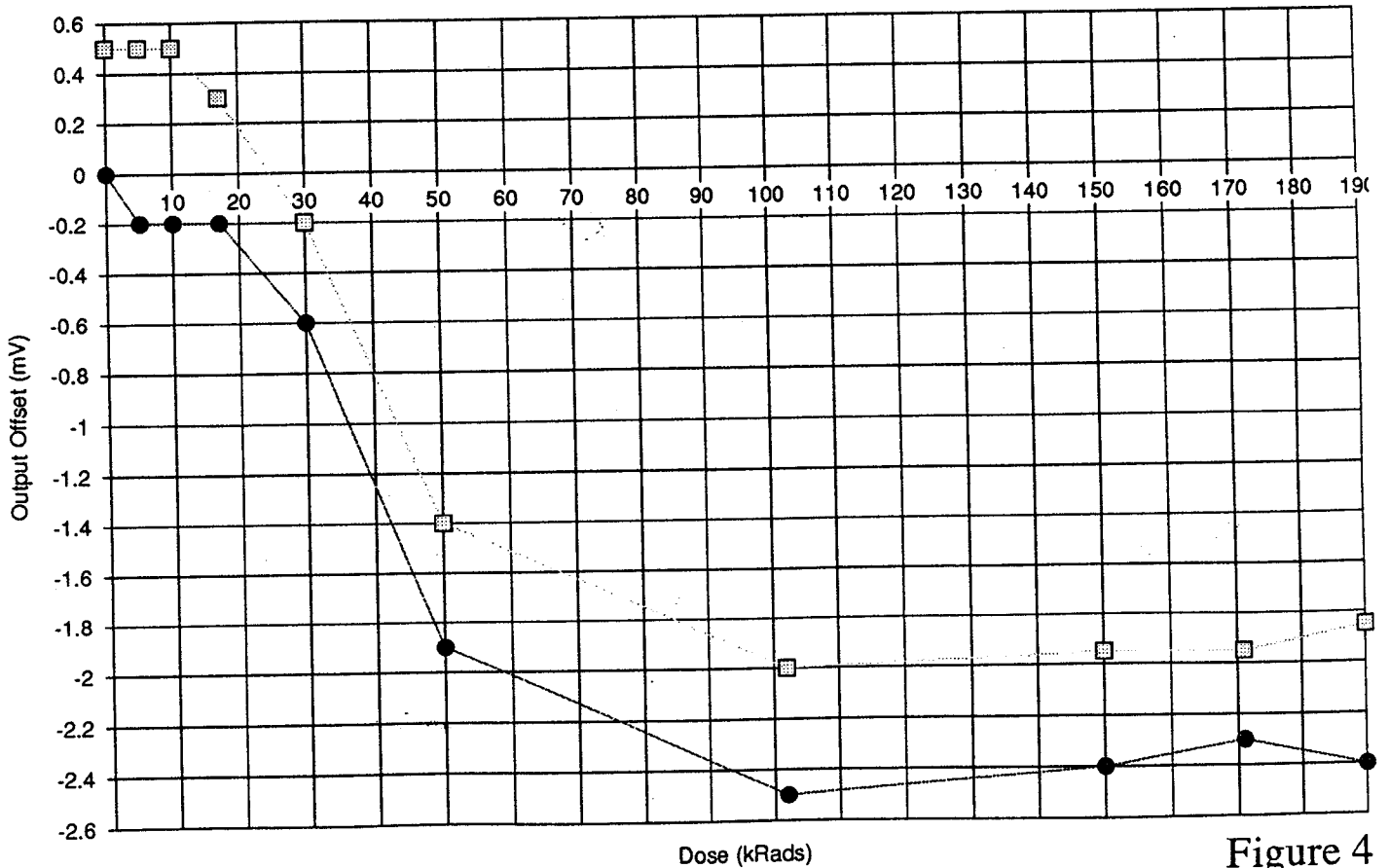


Figure 4

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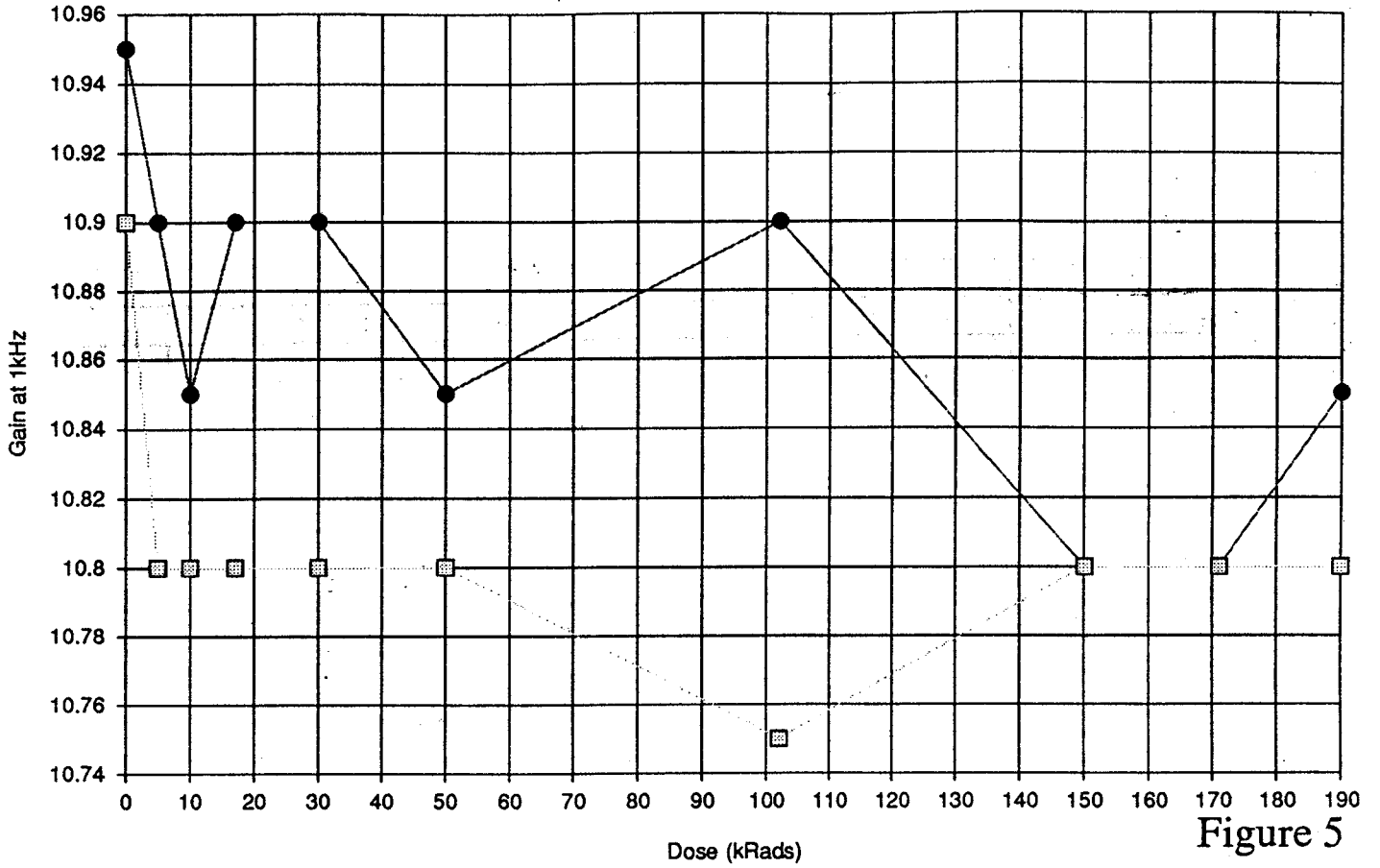


Figure 5

Radiation Testing of XMM EPIC MOS Preamps

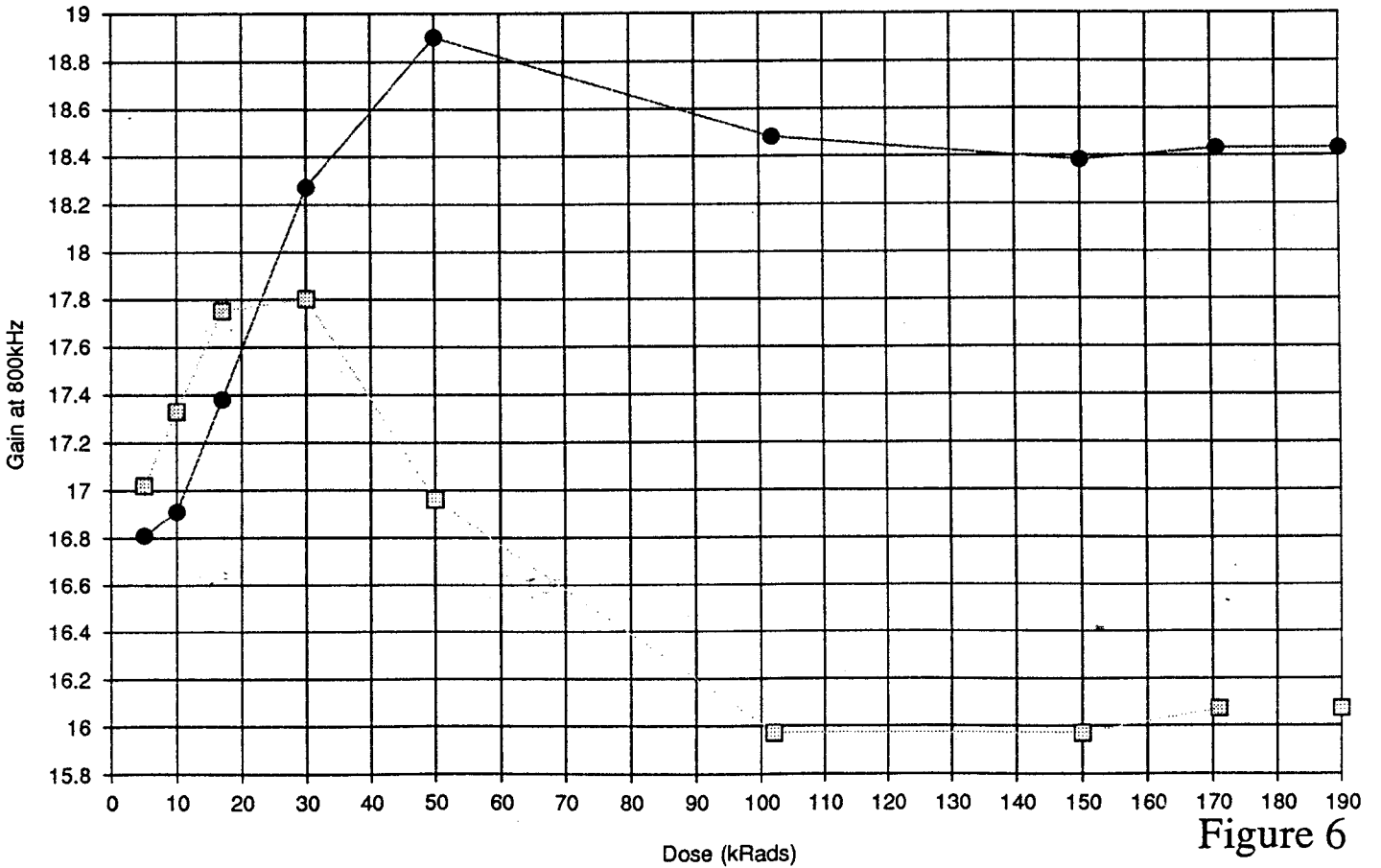


Figure 6

Radiation Testing of XMM EPIC MOS Preamps

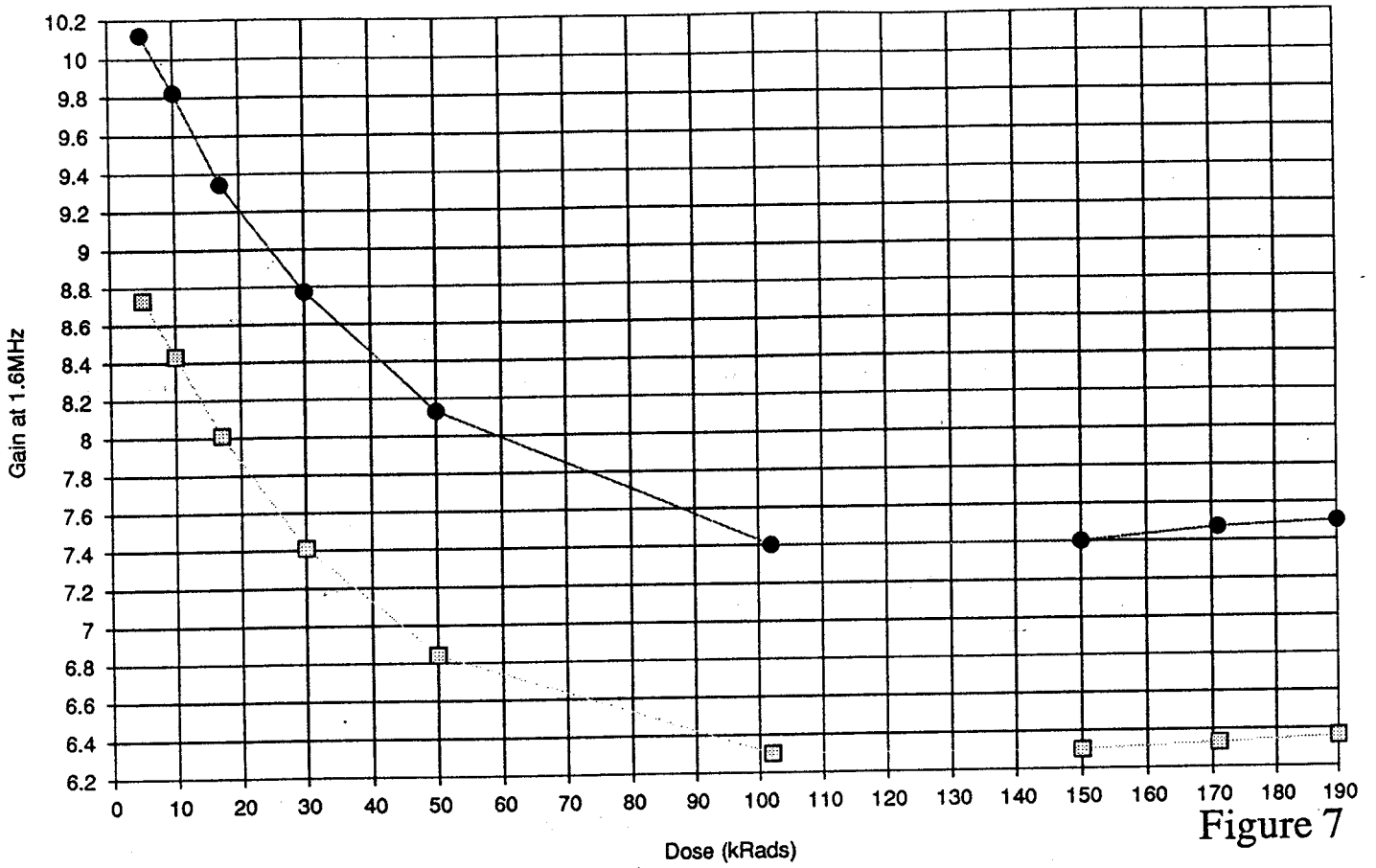


Figure 7

Radiation Testing of XMM EPIC MOS Preamps

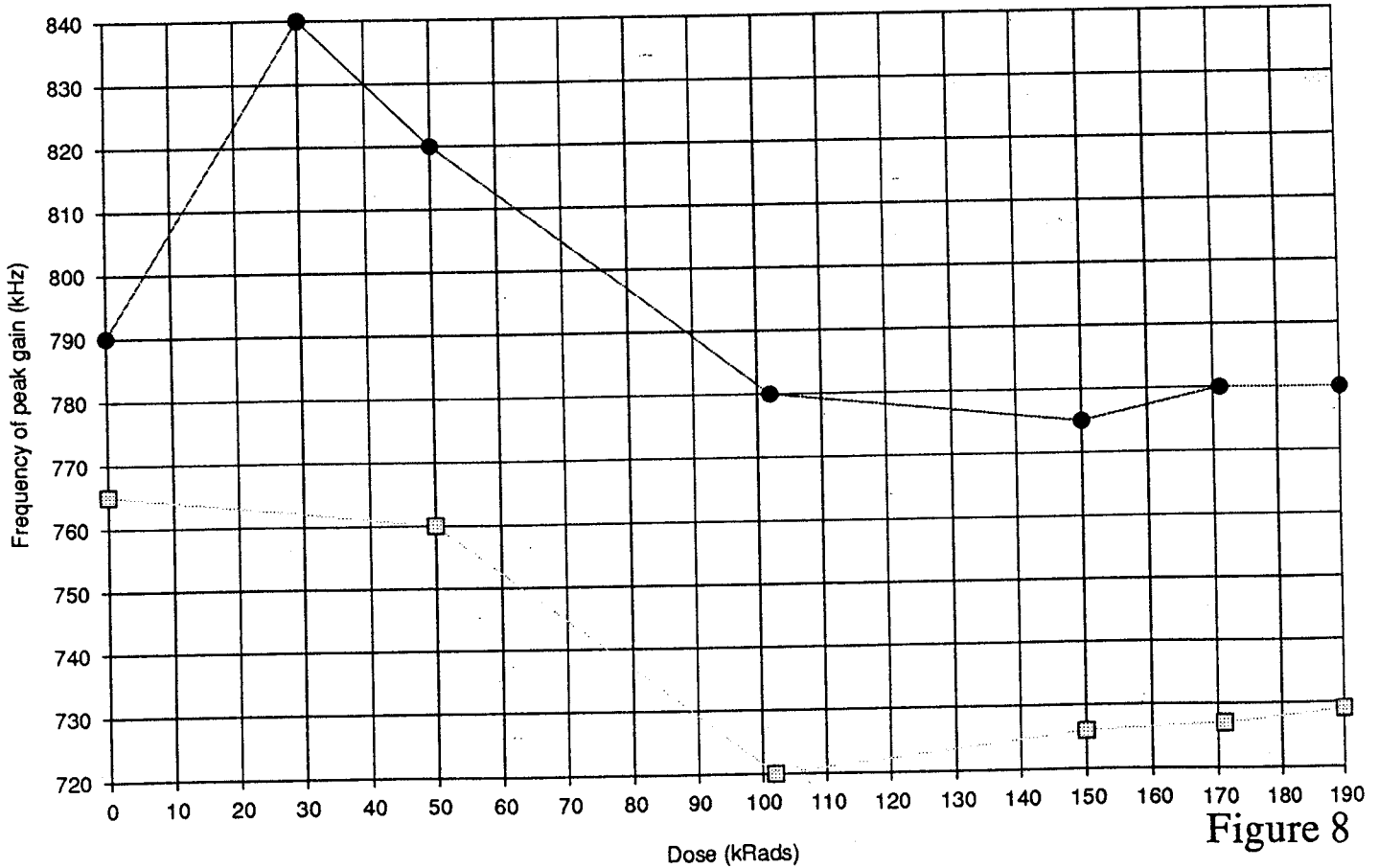


Figure 8