[redacted] 25X1

THIRD MONTHLY LETTER REPORT ON IMAGE ENHANCEMENT (U)

(1 November 1966 to 30 November 1966)

[redacted] 25X1

Task Order No. 18

9 December 1966

[redacted] 25X1

THIRD MONTHLY LETTER REPORT ON IMAGE ENHANCEMENT (U)

In the last monthly progress letter we indicated that the sensitometry with the Recordak Microfile film was nearing completion. Although the work took slightly more time than was initially anticipated, it is now substantially complete.

One of the principal reasons for choosing Recordak film, besides its high resolution (> 300 ℓ/mm) and high speed (ASA 64), was the existence of a positive reversal processing technique developed at this laboratory that caused no significant resolution loss when compared to contact printing reversals that are usually necessary for constructing positive transparencies of holograms. In the past month we have succeeded in adjusting the processing techniques to yield a specular gamma of ± 2 within 5%.

The procedure for obtaining sensitometric data of films to be used for hologram or aberrated image recording is as follows. The film sample is exposed to a photometrically measured intensity distribution of specified parameters. The specular transmittance of the film sample is subsequently measured in the Fourier transform system that is used for image restoration. Thus the sensitometric data is obtained as a function of wavelength, coherence, and the specific system applications. Our results indicate that there are no significant color and/or coherence effects detectable on two identically processed films when one is exposed by red laser radiation and the other is exposed by incoherent green light when both densities are measured with a standard wide angle densitometer. However, when the density is measured with a Fourier transform system, the gamma is approximately 15% higher than would be obtained using the wide angle densitometer generally used for film sensitometry. Data from a narrow angle densitometer (microdensitometer) falls midway between the other two sets

of data. These results are graphically presented in Figures 1 a, b, c.

Work has also been applied to correcting motion aberrated images. A technique has been devised to move a target at constant velocity while being photographed. Examples of a resolution target with and without a motion induced aberration are presented in Figure 2. A resolution target was chosen for the first experiment to determine the efficiency of the filtering operation. Work is now in progress to construct filters to correct the aberrated resolution target and results of these experiments will be reported next month. Continuous tone imagery will also be studied and the results obtained will be compared to results from in-line spatial filtering.

PROGRAM SCHEDULE FOR "IMAGE RESTORATION"

A program schedule has been written for the mutual benefit of those involved with this contract. The schedule is outlined in generalized categories as it is only intended to give a view of the direction of the program and the scheduled progress desired during the time of the program. The outline has been divided into two parts, the first including the work that has been essentially completed to date, and the second consisting of the planned direction and schedule through the remainder of the contract. Because of the nature of a research contract it must be noted that the completion date of any one program goal does not preclude continued effort related to that goal. For instance, though the Fourier transform hologram system was basically completed at the end of the first month, several improvements have since been incorporated. The program schedule is as follows:

PART I

- Fourier Transform Hologram System
  - System fabrication
  - System testing
    - Illumination
    - Resolution
- Sensitometry
  - Film choice
  - Processing parameters (direct and reversal processing)

Measurement of Specular Transmission on Fourier Transform System (including coherence and wavelength parameters)

Relating Specular Measurements to Microdensitometer Measurements and Macrodensitometer Measurements

Confirmation of Linearity

Coherent Spatial Filtering System

Lens Purchase and Set-up

Tentative Completion: 10 December 1966

PART II

Symmetric Aberration Restoration

Generation of Aberration (linear motion)

Filter Generation (hologram and inverse amplitude filter)

Testing and Analysis of Hologram Filter

Image Restoration

Analysis and Comparison to In-Line Inverse Filtered Results

Tentative Completion: 27 January 1967

Asymmetric Aberration Restoration I

Generation of Aberration (simple geometry, e.g., "L" shaped)

Filter Generation (hologram and inverse amplitude)

Testing and Analysis of Filter

Image Restoration

Analysis and Comparison with Theoretical Estimates

Tentative Completion: 14 April 1967

Asymmetric Aberration Restoration II

Generation of Random Aberration

Filter Generation

Image Restoration and Analysis

Obtaining Representative Data of Imagery

Tentative Completion: 21 July 1967

Comparison of filtered results with hologram filter alone (matched filtering) and with combined hologram and inverse amplitude filteri(inverse filtering)

Comparison of above results will be made with those obtained from inverse filters generated by a computer-photofacsimile system, tentative on progress of the latter work for such a comparison.

Completion Date: 30 August 1967

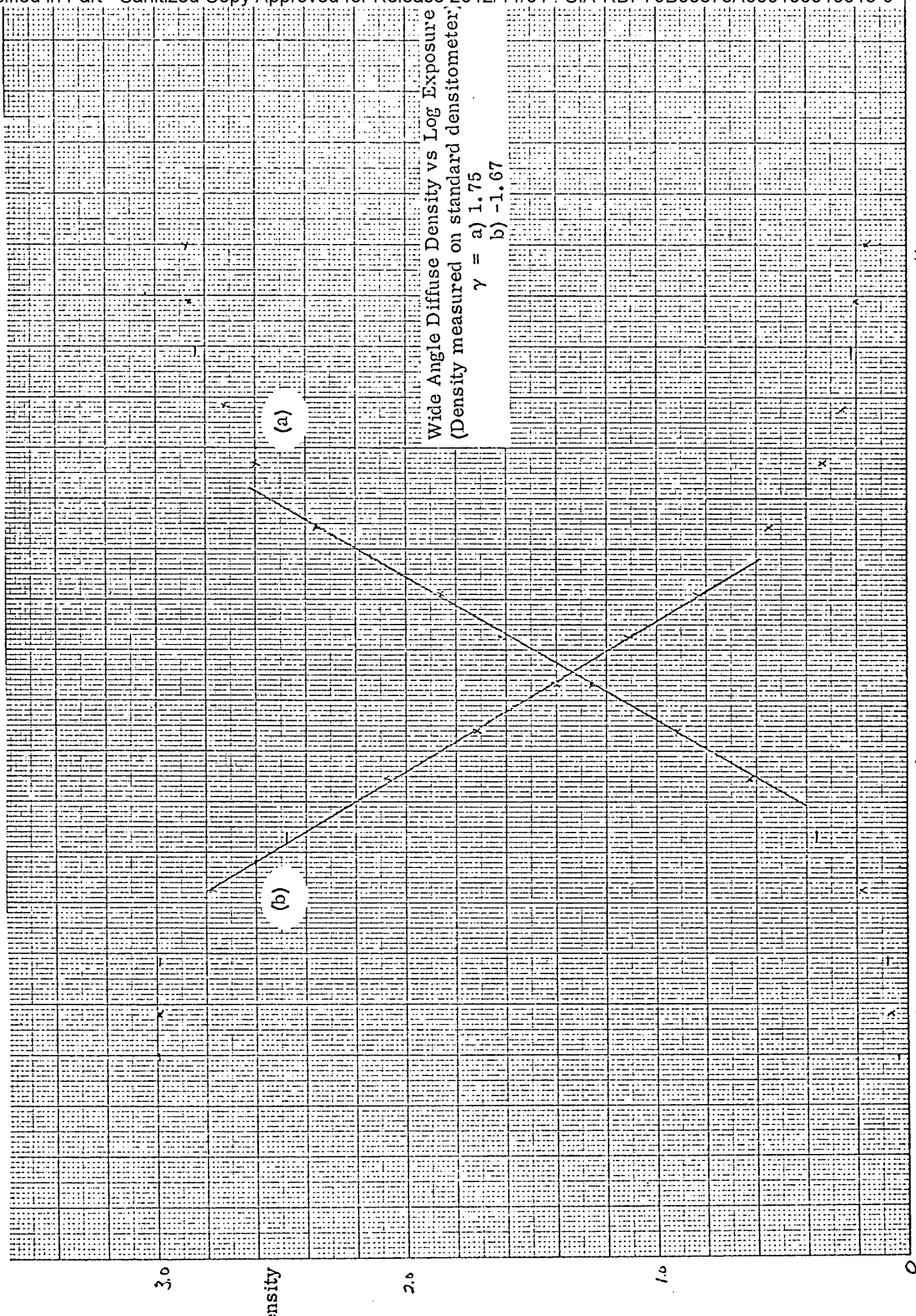
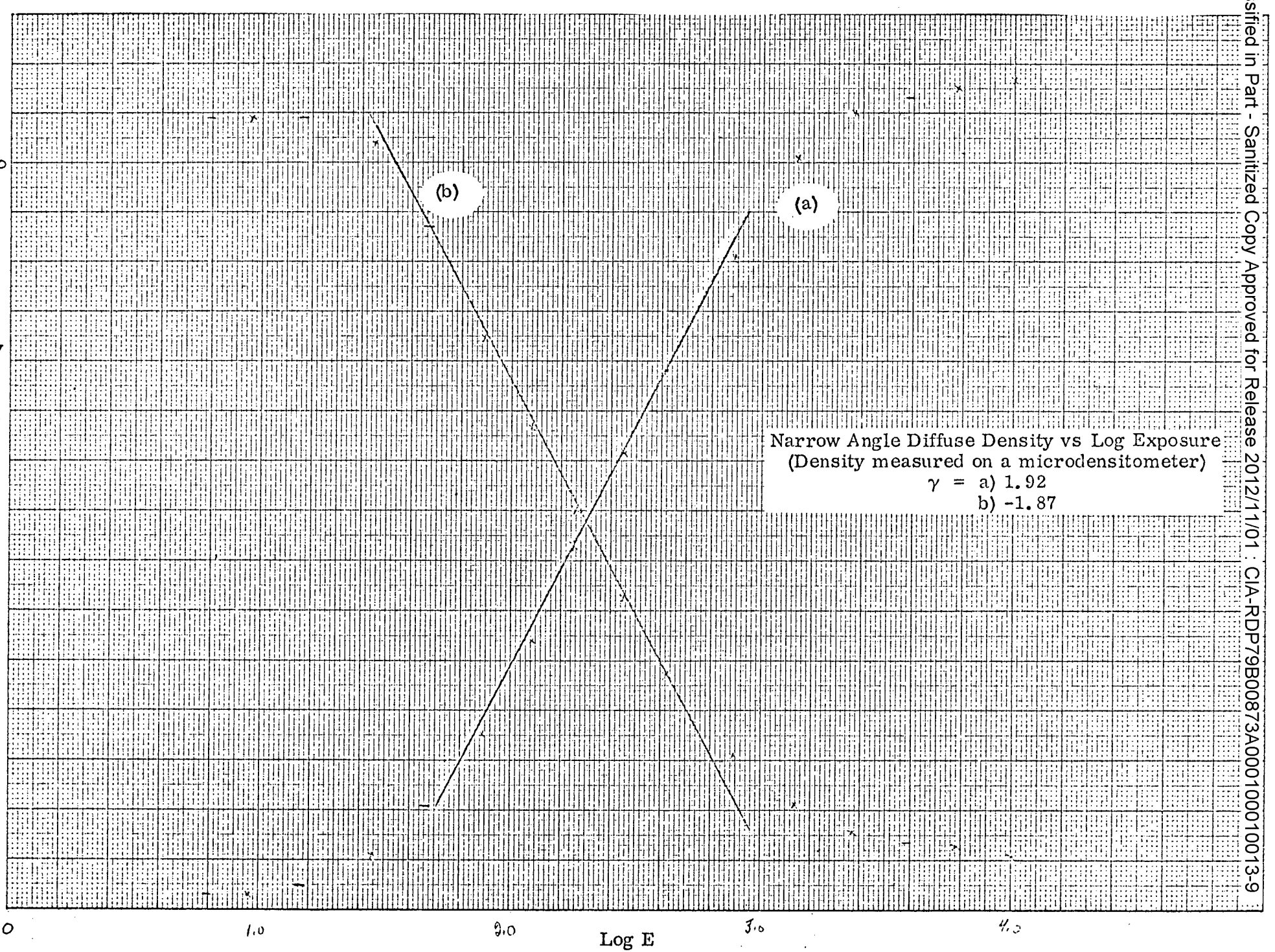


Figure 1(a)

Figure 1(b)



Declassified in Part - Sanitized Copy Approved for Release 2012/11/01 : CIA-RDP79B00873A000100010013-9

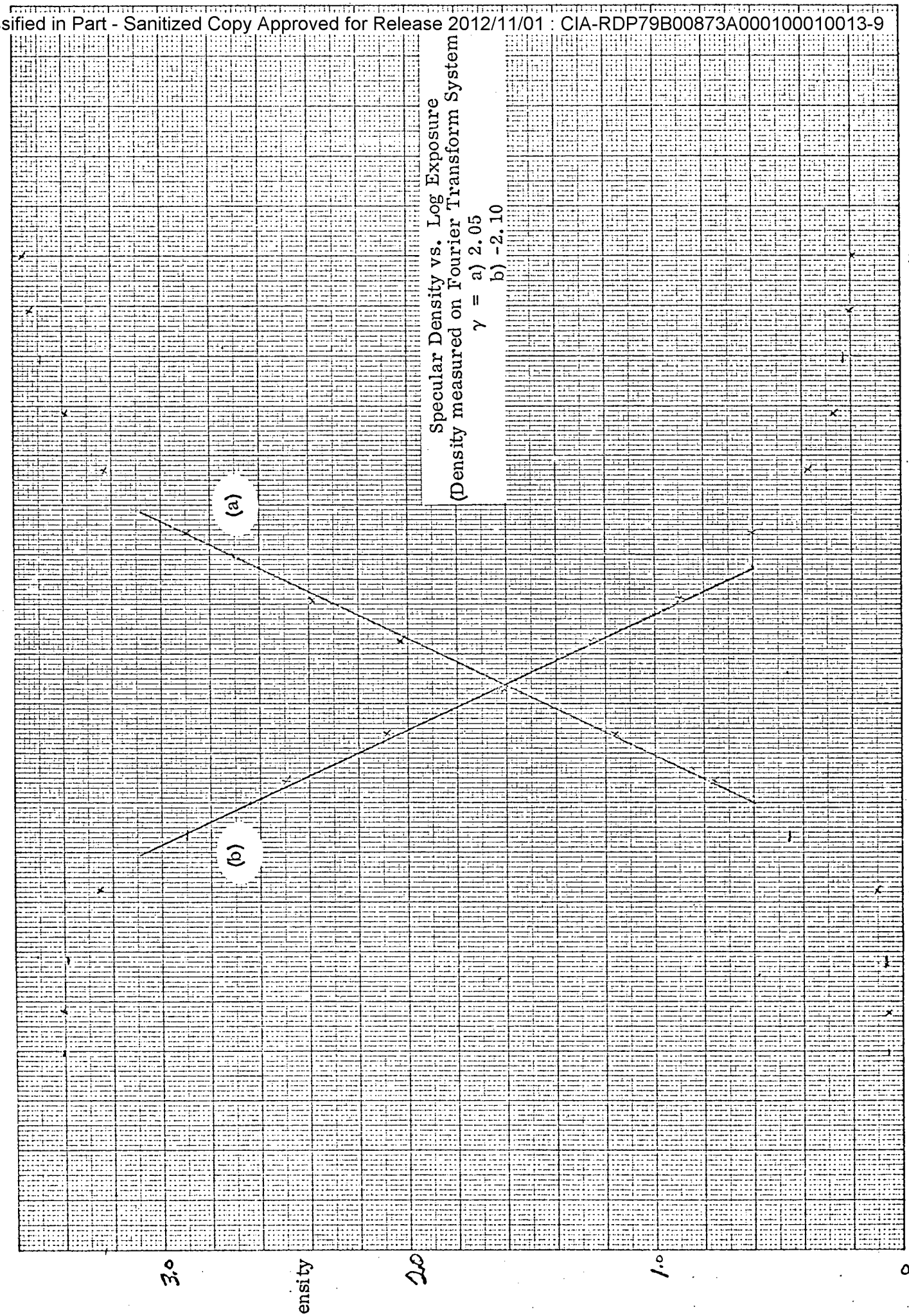


Figure 1(c)