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RADIO FREQUENCY INTERFERENCE SURVEY
ON THE AMPEX TELEVISION DATA SYSTEM

Organization 7300 Environmental Test Report

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**RADIO FREQUENCY INTERFERENCE SURVEY
ON THE AMPEX TELEVISION DATA SYSTEM**

Introduction

Ampex Corporation is presently fabricating a television data system (TDS) at their plant in Redwood City, California. Sandia Corporation is contemplating the purchase of such a system for use at Sandia Corporation, Albuquerque. It was requested that Division 7333 perform a radio frequency interference (RFI) survey on the Ampex television data system to determine the levels of radiated and conducted signals and interference generated by the TDS. The test was performed at the Ampex plant during the week of August 8 - 11, 1967.

Summary

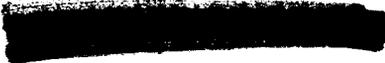
Measurements of conducted and radiated RFI were made on the K&E camera copying head with associated electronics, monitor, video electronics unit (VEU), tape deck, buffer, and printer.

The frequency spectrum for conducted RFI measurements was 30 Hz to 100 MHz. The frequency spectrum for radiated RFI measurements was 30 Hz to 200 MHz. The ambient background levels with the TDS off, consisting of noise and local stations, were quite high over various parts of the spectrum.

Conducted RFI measurements on the power lines of all units disclosed only the sync pulses from the sync generator within the system. This was observed in the 30 Hz - 15 kHz frequency range. No video was detected. The sync signals were also picked up on various other interconnecting lines such as input lines, output lines, sync lines, etc.

Radiated RFI measurements showed that the fluorescent background lighting system for the K&E camera copying head served as a broadband noise generator from 30 Hz to 15 kHz. The video scan line signal for the monitor was also observed from 30 Hz to 360 MHz. The only video data observed occurred at 9.5 MHz while surveying the printer and its associated electronics. The printer electronics generated a 9.5 MHz carrier which appeared to be a spurious oscillation. Ampex personnel indicated this carrier was not a design intent of the system. The application of modulated video from the VEU to printer modulated this spurious carrier and this signal was detected 6 feet away from the printer electronics.

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Procedure and Results

Table I lists the equipment used in performing the RFI survey on the Ampex TDS. For conducted RFI measurements, the Stoddart Current Probe, Model 91550-1, was used as the pickup device. It has a frequency response of 30 Hz to 100 MHz. For radiated RFI measurements, a dipole antenna was used from 30 Hz to 15 MHz, and from 30 MHz to 200 MHz. A vertical rod antenna was used from 15 kHz to 30 MHz.

Figure 1 shows the layout of the test items within the Ampex building. It should be noted that there were many other pieces of equipment in the building; however, most equipment in the main room was turned off during the survey. The ambient background noise and signal levels were in the millivolt range at the input to the receiver with the Ampex TDS turned off for both radiated and conducted RFI measurements. The broadband noise was mainly in the frequency range of 30 Hz to 25 MHz. The narrowband signals were predominately seen in the AM broadcast band (535 kHz to 1605 kHz), the FM broadcast band (88 MHz to 108 MHz), the TV broadcast band (54 to 88 MHz and 174 to 216 MHz) and the communications and shortwave bands. Figures 2-4 show the ambient background levels and detected signals measured during the test.

Conducted RFI Survey

The current probe was placed around powerlines, sync lines and input- and output lines of all six units. Power was applied to each unit, individually, and video was transmitted between the various units. The only change in the ambient level occurred when the sync generator was turned on in the VEU. Sync pulses were observed on all lines; however, no video signal was observed during any of the conducted RFI measurements. The sync pulses were observed from 30 Hz to 15 kHz. The level of conducted interference was 40 db above 1 μ v/MHz at the receiver input. Fed. Std. 222 limit in this range is 34 db above 1 μ v/MHz.

Radiated RFI Survey

The various receiving antennas were placed at distances of one to three feet from each of the six test items. Power was applied to each unit individually and video was transmitted between the various units. An increase in the ambient background level occurred when the fluorescent background lighting for the K&E camera copying head was turned on. The lights acted as a broadband noise generator from 30 Hz to about 15 kHz. The receiving antenna was placed about three feet from the center of the lights in front of the K&E camera copying head at this time. With the lights off, no video signal was detected at this location; however, the video scan line signal was observed up to 360 kHz.

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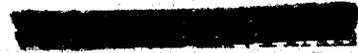
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The only radiated video signal occurred at 9.5 MHz and was 71.5 db above 1 uv/M at 3 feet from the printer. The Fed. Std. 222 limit at this frequency is -6 db above 1 uv/M. The printer electronics radiated a 9.5 MHz carrier, which appeared to be a spurious oscillation. Ampex personnel indicated that this carrier was not a design intent of the system. The application of modulated video from the VEU to printer modulated the spurious 9.5 MHz carrier. This radiated signal was observed up to 6 feet from the printer electronics. The physical size of the room, where the printer was located, limited the distance the antenna could be moved back from the printer. It should also be noted, that during such operation of the printer, ozone was quite noticeable, even though the environment is controlled for temperature and humidity. The level of ozone should be checked.

Due to the high ambient background levels in the area in which the measurements were made, it is impossible to state with assurance that all video signals, either conducted or radiated, were observed.

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TABLE I

TEST EQUIPMENT FOR RFI SURVEY

<u>Nomenclature</u>	<u>Model</u>	<u>Manufacturer</u>
FI Meter	NF-105	Empire
RI-FI Meter	NM-40A	Stoddart
Spectrum Analyzer	HP-8551A	Hewlett-Packard
Current Probe	91550-1	Stoddart
Signal Generator	HP-606A	Hewlett-Packard

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Test Items

- 1 - K&E Camera Copying Head
(also lights)
- 2 - Monitor
- 3 - Video Electronics Unit (VEU)
- 4 - Tape Deck (Transport)
- 5 - Buffer
- 6 - Printer

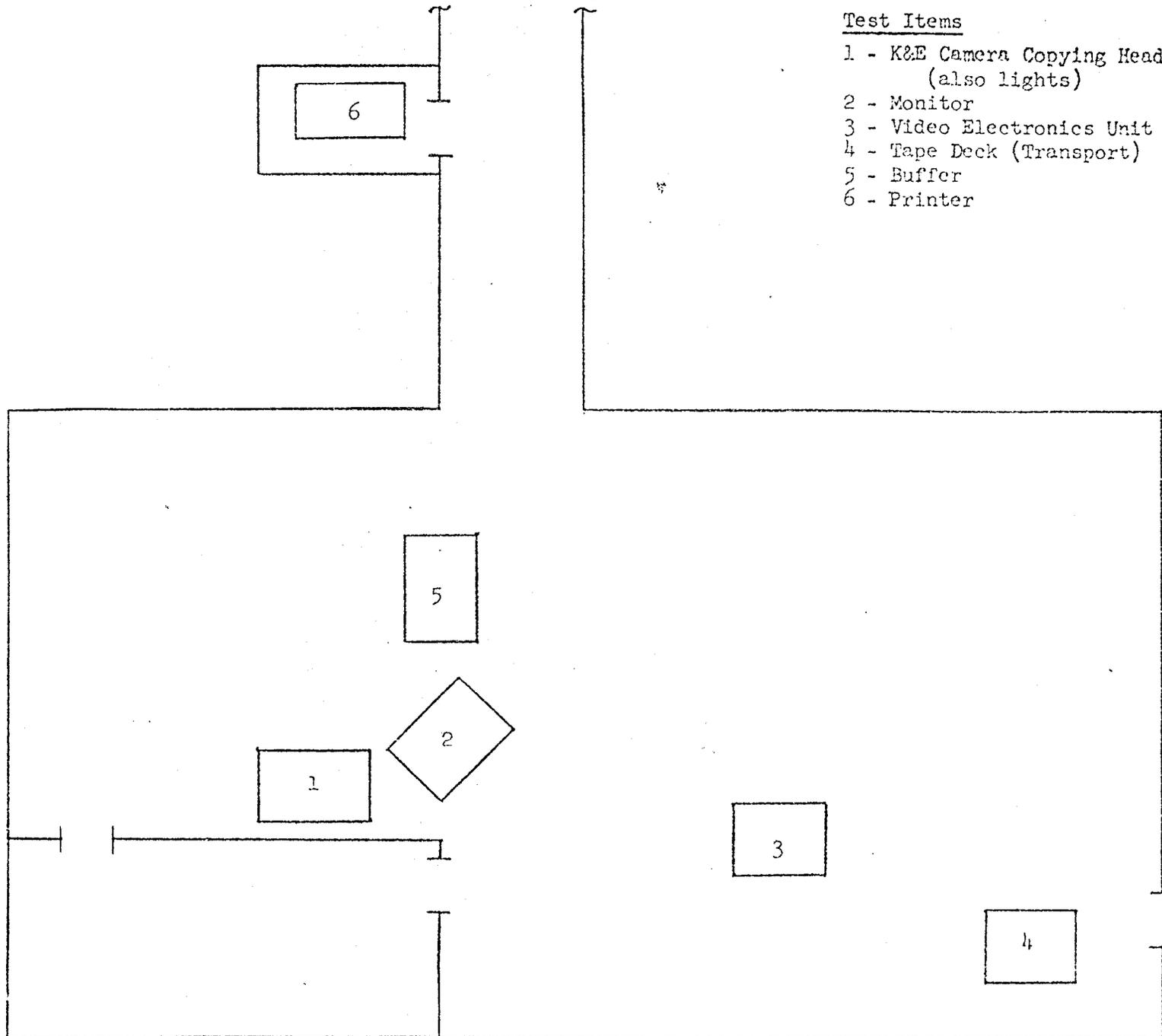


FIGURE 1 LAYOUT OF TEST ITEMS AT AMPEX CORPORATION FOR RFI SURVEY

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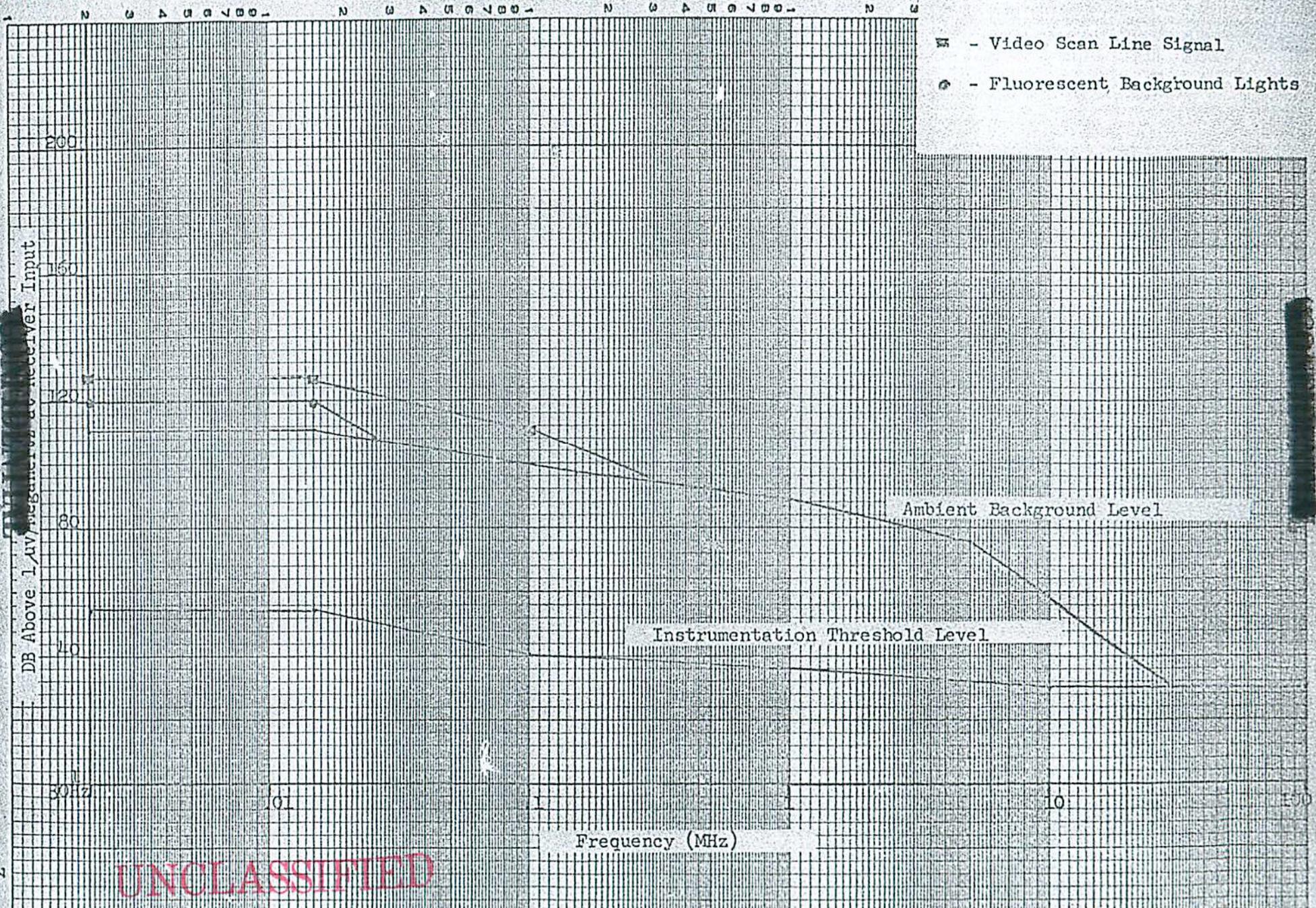


FIGURE 2 RELATIVE AMPLITUDE OF AMBIENT BROADBAND BACKGROUND NOISE AND DETECTED SIGNALS FROM TDS

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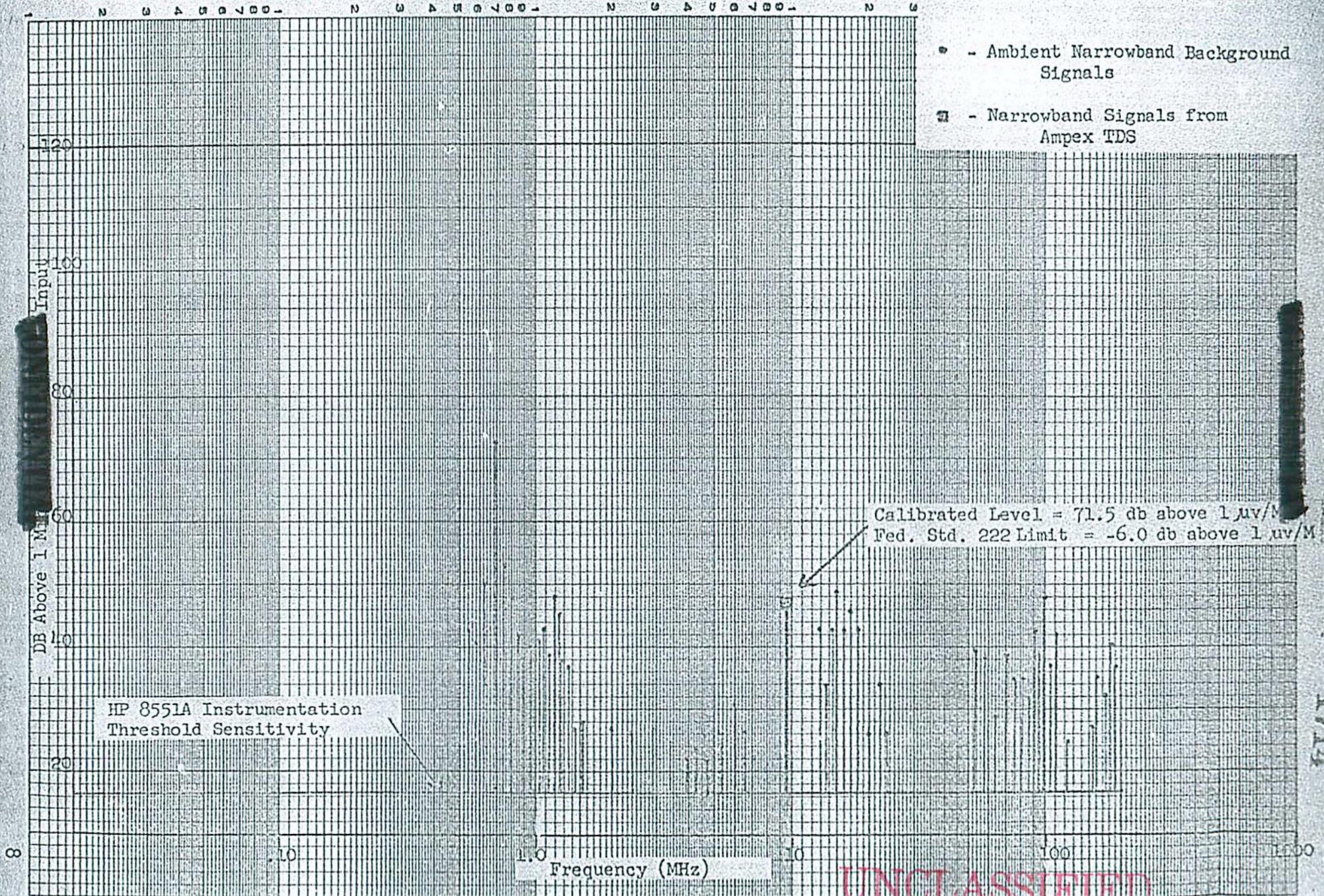


FIGURE 3 RELATIVE AMPLITUDE OF AMBIENT NARROWBAND BACKGROUND SIGNALS AND DETECTED SIGNALS FROM TDS

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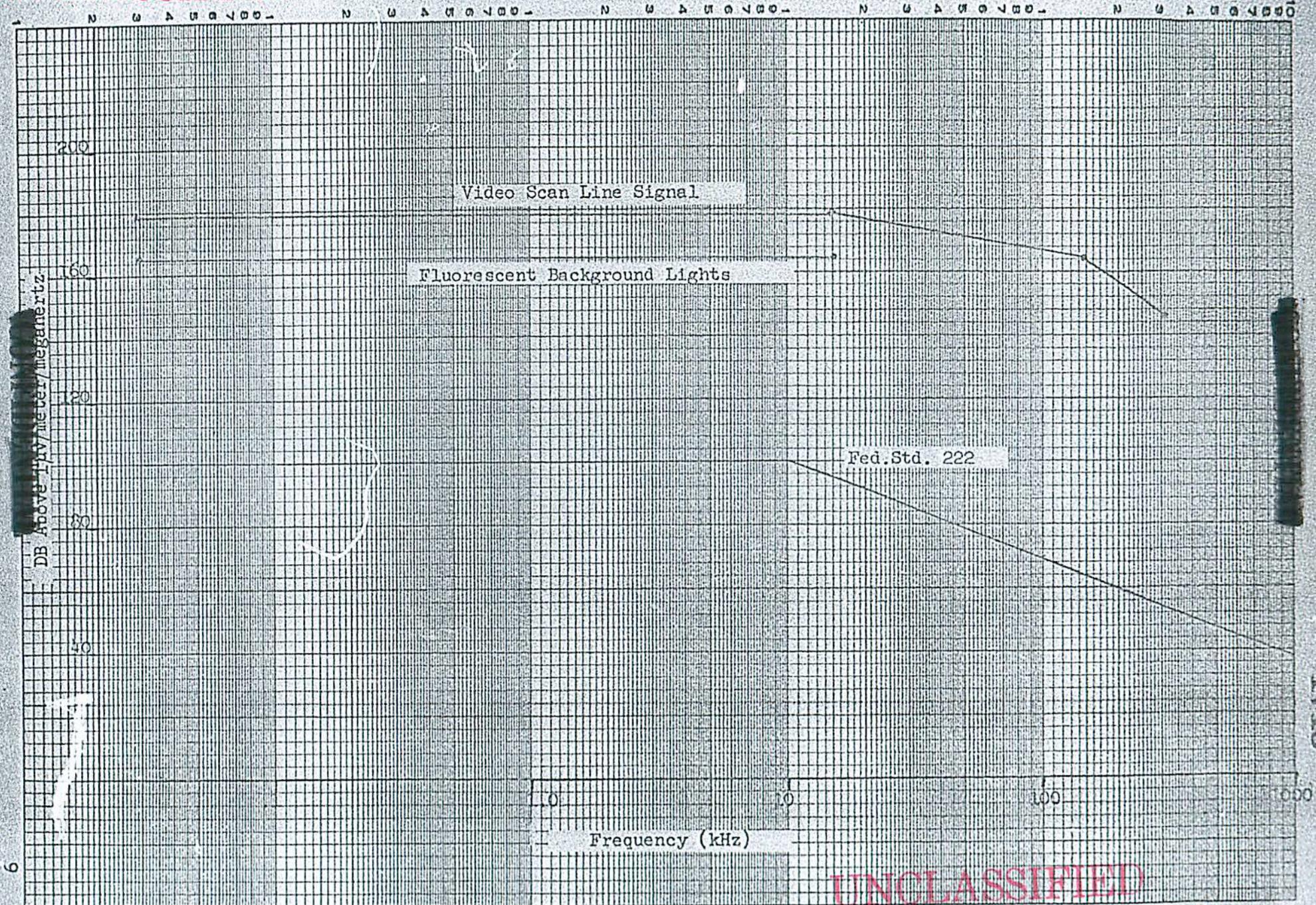


FIGURE 4 CALIBRATED LEVELS OF BROADBAND RFI FROM AMPEX TDS

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