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ELECTRICAL ENGINEERING RESEARCH LABORATORY
THE UNIVERSITY OF TEXAS
Austin, Texas

QUARTERLY ENGINEERING REPORT NO. 3

Research on Electromagnetic Wave Propagation Effects in Dynamic Situations

1 November 1962 - 31 January 1963

Contract AF 33(657)-8716
Project No. 4062

Aeronautical Systems Division
Air Force Systems Command
Wright-Patterson Air Force Base, Ohio

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I. INTRODUCTION

This is the third Quarterly Engineering Report of research activities at The University of Texas, sponsored by the Aeronautical Systems Division, Air Force Systems Command, under Contract AF 33(657)-8716. The measurement technique described in this report, that of free space propagation of coherent signals over short paths "parallel" to the earth's surface, is one of the methods that is being used to investigate the emission and absorption of wavelengths between 100 and 160 kMc/s.

II. FREE SPACE PROPAGATION INSTRUMENTATION AND MEASURING TECHNIQUES

Generation of wavelengths between 100 and 160 kMc/s at nominal instrumentation and operating costs is accomplished by exciting silicon or germanium point contact rectifiers with 50 to 80 kMc/s energy. The 50 to 80 kMc/s energy is derived from Raytheon type klystrons. The harmonic generator crystals and holders are FXR items. Detection of the harmonically generated 100 to 160 kMc/s energy is accomplished by heterodyning with harmonically generated local oscillator energy to an intermediate frequency of 30 Mc/s.

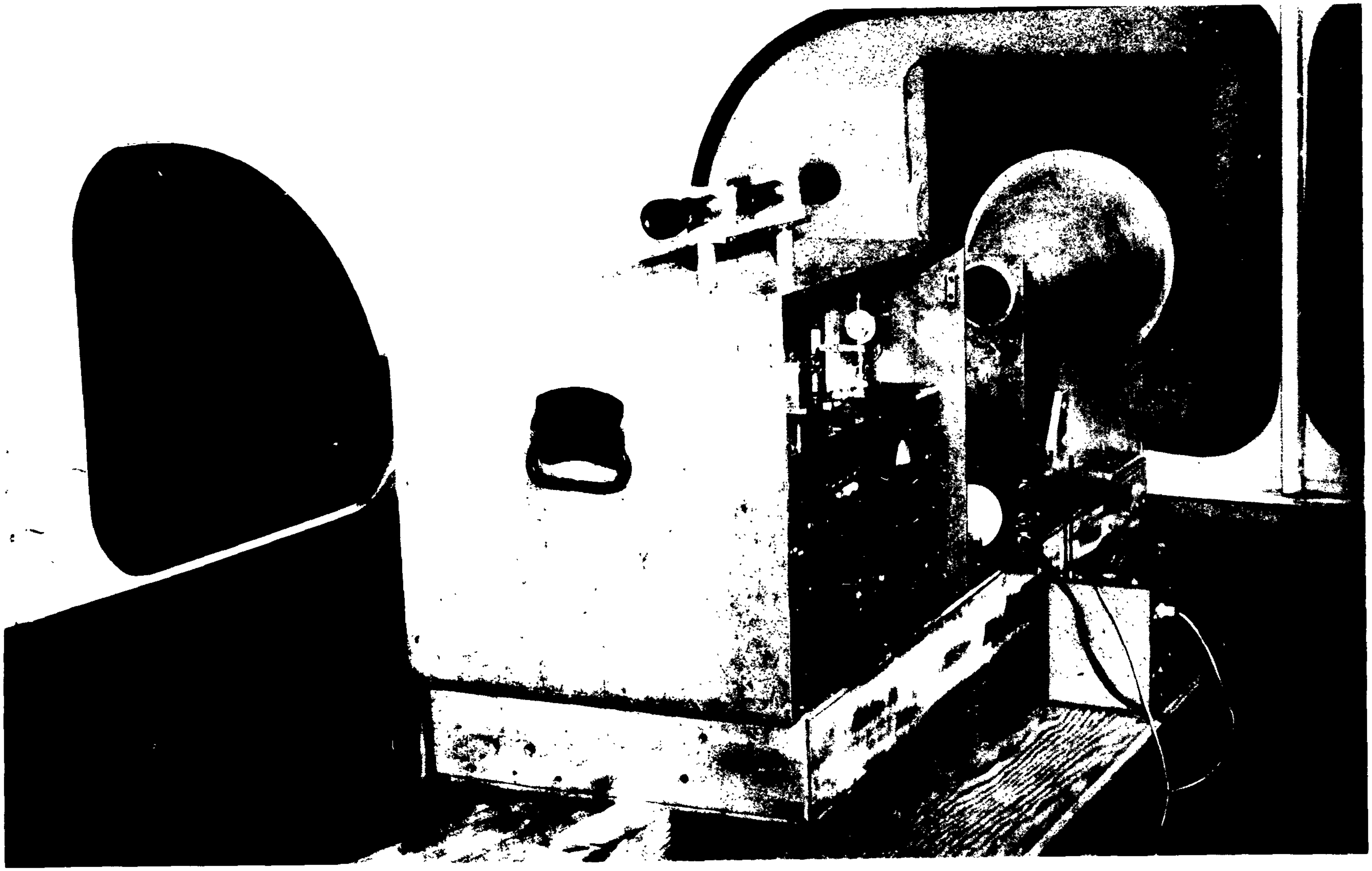
Photographs of the transmitter and receiver are shown in figures 1 and 2. The transmitting and receiving antennas are 11 inch diameter lens-horns with beam widths of approximately 0.65° at 120 kMc/s.

The free space signal strength propagation measurements are being made over path lengths of 840 feet, 420 feet and 210 feet. If there are no signal attenuations other than free space dispersion and atmospheric gas losses, the difference in attenuation over the two paths, 420 to 840 feet and 210 to 420 feet, will be equal to the atmospheric losses over the 210 to 420 foot path.

A photograph of the mobile bus-mounted transmitter is shown in figure 3. The lens of the transmitting antenna can be seen protruding from the back of the bus. The transmitting and receiving antennas are aligned with telescopic gunsights.

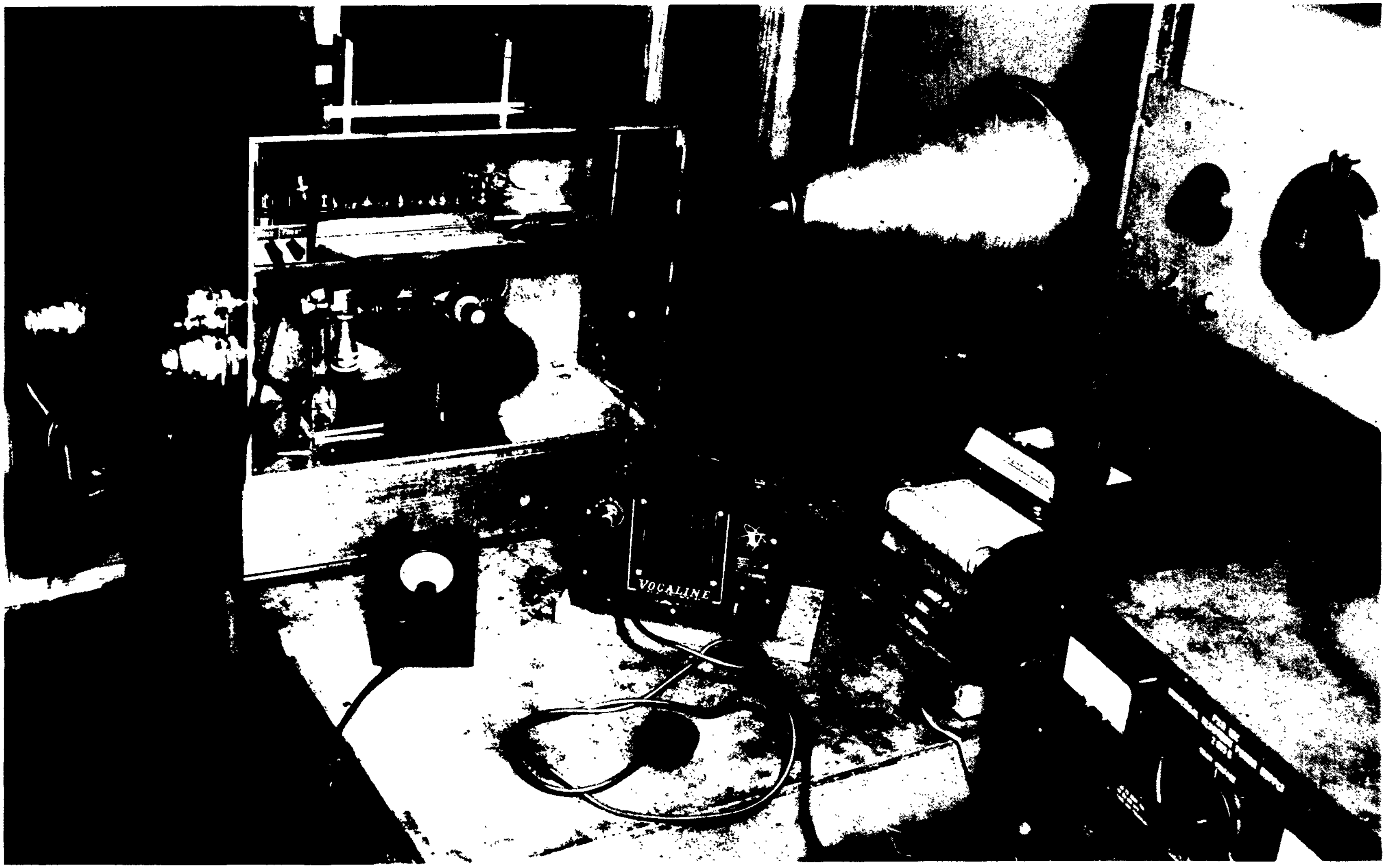
In order to maintain the heterodyne frequency of the transmitter and receiver within the passband of the intermediate frequency amplifier, the receiver local oscillator klystron is frequency modulated and the passband of the intermediate frequency amplifier displayed on an oscilloscope. The intermediate frequency passband pulses are peak-detected and their amplitude recorded on a pen and paper recorder. A millimeter waveguide attenuator between the receiver antenna and harmonic generator-detector is adjusted for equal recorder levels when propagating over each of the path lengths. The difference in the waveguide attenuator values for path length changes of 210 feet and 420 feet is equal to the value of atmospheric attenuation over the 210 foot long path.

The measurements are being repeated each day weather permits at three or more frequencies in the vicinity of 118.75 kMc/s. The frequencies being measured thus far lie between 117.00 and 121.50 kMc/s. Observed values of atmospheric attenuation are being correlated with observed values of atmospheric water vapor density.



PHOTOGRAPH OF 100-160 kMc/s TRANSMITTER

FIG. 1.



PHOTOGRAPH OF 100-160 kMc/s RECEIVER

FIG. 2.

PHOTOGRAPH OF MOBILE TRANSMITTER

FIG. 3.

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