

MASSACHUSETTS INSTITUTE OF TECHNOLOGY
RADIATION LABORATORY SERIES

LOUIS N. RIDENOUR, *Editor-in-Chief*

MICROWAVE MIXERS

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MICROWAVE MIXERS

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Foreword

THE tremendous research and development effort that went into the development of radar and related techniques during World War II resulted not only in hundreds of radar sets for military (and some for possible peacetime) use but also in a great body of information and new techniques in the electronics and high-frequency fields. Because this basic material may be of great value to science and engineering, it seemed most important to publish it as soon as security permitted.

The Radiation Laboratory of MIT, which operated under the supervision of the National Defense Research Committee, undertook the great task of preparing these volumes. The work described herein, however, is the collective result of work done at many laboratories, Army, Navy, university, and industrial, both in this country and in England, Canada, and other Dominions.

The Radiation Laboratory, once its proposals were approved and finances provided by the Office of Scientific Research and Development, chose Louis N. Ridenour as Editor-in-Chief to lead and direct the entire project. An editorial staff was then selected of those best qualified for this type of task. Finally the authors for the various volumes or chapters or sections were chosen from among those experts who were intimately familiar with the various fields, and who were able and willing to write the summaries of them. This entire staff agreed to remain at work at MIT for six months or more after the work of the Radiation Laboratory was complete. These volumes stand as a monument to this group.

These volumes serve as a memorial to the unnamed hundreds and thousands of other scientists, engineers, and others who actually carried on the research, development, and engineering work the results of which are herein described. There were so many involved in this work and they worked so closely together even though often in widely separated laboratories that it is impossible to name or even to know those who contributed to a particular idea or development. Only certain ones who wrote reports or articles have even been mentioned. But to all those who contributed in any way to this great cooperative development enterprise, both in this country and in England, these volumes are dedicated.

L. A. DuBRIDGE.

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Preface

THIS volume describes the design of the various microwave circuits that have been used as mixers in the microwave region at the Radiation Laboratory. The mixers convert the microwave signal into a signal at a lower frequency, where conventional lumped-constant circuits and multiple-element vacuum tubes are used. For information concerning the design of a complete microwave superheterodyne receiver, of which the mixer is a part, Vol. 23 of this series is recommended. Low-frequency amplifiers of many types, for use following the mixer, are described in Vol. 18. A complete treatment of crystal rectifiers, which are the hearts of the mixers described in the present volume, is given in Vol. 15. Duplexing circuits often required in pulse radar, and the tubes used in them are described in Vol. 14. Low-level oscillators, which are used as local oscillators for the mixers, are treated in Vols. 7 and 11. Because the frequency of the local oscillator determines the sensitive frequency of the mixer, automatic frequency control has been considered to be closely related to the mixer; for this reason, the chapter on this subject by Eric Durand has been included in this volume.

I wish to take this opportunity to thank H. F. Webster for his cooperation in the design of the mixers developed at the Radiation Laboratory from 1943 to 1945, and Florence M. Carroll and Rosemarie Saponaro for their very great assistance in the preparation of the manuscript.

R. V. POUND.

CAMBRIDGE, MASS.
June, 1946

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