

IEEE Recommended Practice for Antenna Measurements

IEEE Standards Antennas and Propagation Society

Developed by the
Antennas and Propagation Standards Committee

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Antennas and Propagation Standards Committee
of the
IEEE Antennas and Propagation Society

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Abstract: The recommended practices for the measurement of antenna transmitting and receiving properties are presented. Throughout this standard it is assumed that the antenna to be measured can be treated as a passive, linear, and reciprocal device. A fundamental property of any antenna is its radiation pattern. The measurement of radiation patterns in an antenna test facility is discussed. The design of antenna test facilities is described along with instrumentation requirements for the proper operation of the antenna facility, directions for the evaluation of an (existing) range, and the operation of ranges is discussed. References are provided that are illustrative of measurement techniques and in which details may be found.

Keywords: absorbers, accuracy, alignment, anechoic, antenna, antenna gain, antenna measurements, calibration, chamber, compact range, EIRP, electromagnetic compatibility, electromagnetic testing, EMC, equivalent isotropically radiated power, errors, evaluation, facilities, far field, far-field range, gain/temperature, ground bounce, high power, IEEE 149, impedance, instrumentation, inter-range comparison, measurement, near-field, near zone, noise, outdoor range, passive, pattern, phase, polarization, probe, quiet zone, radar, radiation, radio frequency, radome, range, receiver, reflector, safety, scale model, scanner, software, standard gain horn, standard, tapered chamber, target support, techniques, test facility, test range, test zone, three-antenna measurement, tracking, uncertainties, uncertainty analysis, verification

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Introduction

This introduction is not part of IEEE Std 149™-2021, IEEE Recommended Practice for Antenna Measurements.

This document is a major revision of IEEE Std 149-1977 (reaffirmed 2008) which it supersedes. As with the rest of industry, much has changed in the area of antenna measurements over the more than four decades that have passed since the last update. While most practitioners are still interested in the fundamental properties of antennas, such as radiation patterns, gain, impedance, and radiation efficiency, the equipment and methods for measuring these quantities have evolved due to improved tools and significant innovation. Many of these advances are discussed herein, however due to the diversity of antenna measurement challenges it was not practical to retain the original mandate as a standard test procedure. Instead, this update has been reclassified as a recommended practices document, with the intent to serve as a guideline for obtaining the highest quality measurements without dictating a specific approach. Consequently, this document is devoid of “shall” directives but full of “should” recommendations, in accordance with the IEEE Standard Association Standards Board Operations Manual.

This revision emphasizes the industry trend away from the outdoor measurements that were common in the 1970s. While some outdoor range content is retained in this document, much of it has been supplanted with information on various indoor measurement techniques, to include far-field anechoic chamber topologies, the compact antenna test range (CATR), reverberation chambers, and some discussion on near-field antenna testing. This revision retains many of the familiar IEEE Std 149-1977 topics on antenna measurement and range evaluation but describes them using industry best-practice techniques and modern equipment. Several new special measurement techniques are included in this revision, along with an entire section devoted to uncertainty evaluation to emphasize the importance of this topic to any measurement of antenna properties. Finally, this revision has been re-formatted and restructured to conform to modern IEEE SA style and layout principles.

Acknowledgments

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